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ABSTRACT

A concept-based introduction to public transportation pricing is presented in this instructional module for undergraduate and graduate transportation-related courses for disciplines such as engineering, business administration, and technology. After an introductory section on transportation pricing planning and the history of transportation system financing, attention is directed to the importance of needs-based planning and market segmentation analysis in pricing planning. Additional topics include: the impact that local impact groups can have on public transportation pricing; the major sources of transportation funding; the complexity of funding sources for public transportation; typical public transportation systems costs; the relationship of system costs to pricing; fare structures; intermodal and bus system transfer policies and their impacts; the way fare collection methods can affect system costs and ridership; complications inherent in multi-modal system coordination; inclusion of private transportation providers through contractual arrangements; and parking pricing strategies. Included are student review questions, study guidelines, and a six-page bibliography. (SW)

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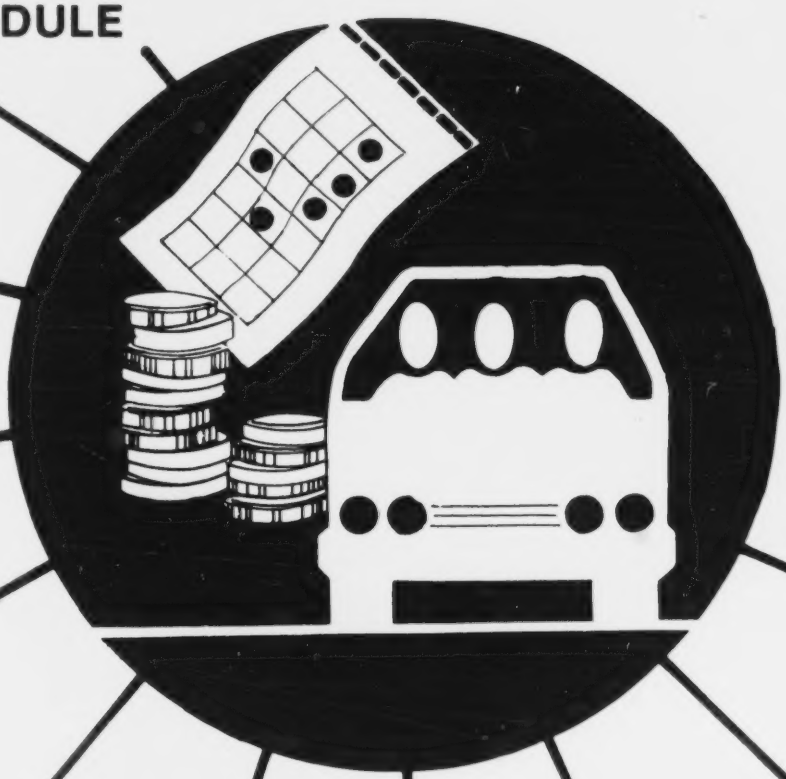

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16. Abstract

This module provides a broad concept-based introduction to the topic of public transportation pricing for use in both undergraduate and graduate transportation-related courses. The material is designed to be useful in many disciplines including engineering, business, administration, and technology.

Public transprotation pricing systems are composed of fare structures and fare collection systems. They are based on consideration of the system users, politics, funding sources, system costs, and system service characteristics. Planning pricing systems involves the balancing of many complex demands. Higher fares can lead to increased revenue generation but they can decrease ridership thereby lowering the social benefits of the transit service. Complicated fare systems can promote equity among riders but they can also make fares difficult to collect efficiently.

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PUBLIC TRANSPORTATION PRICING:

AN INSTRUCTIONAL MODULE

Prepared by
The Transportation Education Project
Technology Education Program
West Virginia University

For
The Office of Service and
Management Demonstrations

Urban Mass Transportation
Administration

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December 1985

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Public Transportation Pricing

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PROFESSOR'S INTRODUCTION

Project Purpose

Since the founding of the Service and Methods Demonstration Program (SMD) in 1974, the Urban Mass Transportation Administration (UMTA) has been intimately involved in the development and diffusion of innovations related to mass transportation. After a decade of experiments and demonstrations, valuable insights and techniques have emerged.

However, students graduating with transportation degrees are often unaware of much of the information which UMTA has developed. These modules were designed to introduce future transportation professionals and people with related interests to five areas where new ideas have proven important in the planning and management of public transportation systems. The topics are:

- Market Segmentation Planning;
- Paratransit;
- Transportation Brokerage;
- Rural Public Transportation; and
- Public Transportation Pricing.

The topics are defined at the end of this introduction and discussed in the General Introduction.

Description of the Modules

These modules are intended to provide a broad, concept-based introduction to each of the five topics for use in both undergraduate and graduate transportation-related courses. The material is designed to be useful in many disciplines, including engineering, business, planning, marketing, public administration, and technology.

One of the major findings of our phone interview in February 1983 was that professors want curriculum packages to be flexible. These modules were designed to be taught for one to three classroom hours. The module text may be used in a number of ways including uses as:

- Lecture notes;
- Student homework readings;
- Overhead transparencies from illustrations; and
- In-class reading and discussion.

All graphic materials labeled as illustrations are designed to be used as overhead projections while graphic materials labeled figures are designed for photocopying.

Professors should feel free to use these materials to supplement regular course design and materials in any way they wish. However, we have placed asterisks in the Table of Contents after sections which we suggest you concentrate on if you only have one hour to teach the module topic. At

the end of each of the three sections of the module, there are Student Review Questions based on the preceding material.

The topics of the five modules have a significant content overlap which is reflected in the module texts themselves. Therefore, some module sections are virtually repeated from one module to another. Professors utilizing more than one of the modules should make allowances for this in planning their presentations.

Persons wishing more detailed and in-depth information on particular topics should refer to the list of references at the end of each module. Sources published by UMTA may be located through the UMTRIS computer database on the DIALOG system or from the National Technical Information Service (NTIS). It may also be possible to obtain recent UMTA Technical Reports and a current bibliography from U.S. DOT/TSC, Service Assessment Division (DTS-64), Kendall Square, Cambridge, MA 02142.

Module Topic Definitions

Market Segmentation

Market Segmentation is a transportation planning approach which involves identifying groups in a market that are "homogeneous with respect to important criteria that influence their travel choices" (Nelson, TRR 823, p. 8).

This approach is associated with integrated mobility-based transportation planning and allows the consideration of a variety of solutions to individual travel needs and markets.

Paratransit

Paratransit refers to modes of passenger transportation which are on a continuum between the private automobile and conventional transit. They are usually available to the general public and able to operate over the street and highway system (Kirby, 1974, pp. 1, 9). Paratransit generally refers to modes such as dial-a-ride, shared-ride taxi, jitneys, vanpools, and so on.

Transportation Brokerage

The transportation broker identifies the transportation needs and demands of various market segments and then matches these needs with available transportation resources. The broker also may resolve barriers to innovative transportation arrangements and implement those arrangements through contracts with social service agencies, employers and private operators. Brokerage is a concept which highlights many of the roles a transportation manager can undertake to provide mobility comprehensively and cost-effectively.

Rural Public Transportation

Rural public transportation involves systems in rural and small urban areas with populations under 50,000 people. Public transportation services in rural areas have often been provided solely by social service agencies serving their clients. New federal programs have facilitated the development of rural systems open to the public but strong local involvement and creativity are needed to create and support such services.

Public Transportation Pricing

Public transportation pricing systems are composed of fare structures and fare collection mechanisms. They are based on consideration of the system users, politics, funding sources, system costs, and system service characteristics. Planning pricing systems involves the balancing of many complex demands. Higher fares often lead to increased revenue generation but they can decrease ridership thereby lowering the social benefits of transit service. Complicated fare systems can promote equity among riders but they can make fares difficult to collect efficiently.

GENERAL INTRODUCTION

Historically, mass transportation in the United States was almost always provided by private, profit-seeking enterprises. The public's interest was usually protected through regulation by a public utility commission. Such commissions controlled entry into the transit business, fares, and the types of service offered.

As the number of automobiles and the quality of roads increased, mass transit ridership suffered a major decline. At the end of World War II, 37% of commuters were riding to work on public transit. By 1979, this figure had fallen to 6%; and there was an automobile for every two Americans. An expanding economy permitted many urban residents to purchase cars and suburban houses.

Mass transportation did not adapt to these changes, and private enterprise gradually withdrew from providing such services. The federal government began to provide financial assistance for transit systems which permitted local governments to take control of them. In the 1960s, the federal government initiated operating subsidies to help curb deficits.

As federal assistance for transportation systems grew, it became evident that the government was spending

increasing sums of money to support transportation systems which were not adjusting to changing conditions. Research into alternative methods of providing public mobility was a necessity. In 1964 Congress created the Urban Mass Transportation Administration (UMTA) to "research, develop, and demonstrate projects in urban mass transportation."

In 1974 UMTA created the Service and Methods Demonstration (SMD) Program to promote the development and widespread adoption of innovative transit services and transportation management techniques. Some of the areas in which UMTA has facilitated major changes are bus and rail equipment design, automation, paratransit, brokerage, integrated planning, and other management innovations.

These modules were designed to introduce students of transportation to information on five topics: market segmentation planning, paratransit, transportation brokerage, rural public transportation, and public transportation pricing. The information in the modules is based on the results of numerous UMTA-funded demonstration and research projects related to these topics. The five topics are introduced on the following pages.

New Directions

Market Segmentation

Public transportation today involves a variety of transportation modes with varying costs and characteristics. A transportation planner must have new planning tools to cope with the complex array of possible systems.

Instead of focusing on transportation systems, the planner should begin by studying the actual mobility needs of the people to be served. Needs-based transportation planning is the only way to ensure services that are fully used and cost-effective. New or modified services which meet the needs of certain groups must then be marketed to inform people of the service's benefits for them.

There are four basic steps to the Market Segmentation planning approach:

1. Market Segmentation Analysis
2. Assessment of Existing Services
3. Analysis of Unmet Needs
4. Targeted Design

Paratransit

Paratransit refers to any public transportation mode which falls on the continuum between the large fixed-route systems (bus, train, etc.) and the private automobile. This includes demand-responsive modes such as Dial-A-Ride and ridesharing modes such as vanpools. Paratransit

systems are designed to be flexible, cost-effective,and targeted to specific needs, but they cannot move large numbers of people on a single route as cheaply as mass transit systems.

Paratransit is being used to serve commuters, the handicaped, the elderly, and others. It works well in low-density or special needs situations where conventional mass transit would be too expensive. Paratransit also can work well as a feeder service for a conventional system.

Brokerage

Suppose a city decides to provide its elderly with a partially subsidized door-to-door service. It would be very expensive to buy cars, maintain them, hire drivers, and so on. It is cheaper to contract with local taxi companies who already have facilities and a workforce. The taxi company provides the service, the elderly give the drivers tickets (provided by the broker) good for part of each fare, and the city buys the tickets back from the taxi company.

In such a case, the transportation planner acts as a broker who matches transportation needs with available services. Rather than operating as a carrier, the transportation broker is primarily concerned with increasing people's mobility with equitable and cost-effective services.

Brokerage is useful in many areas of transportation management, particularly in the provision of flexible, low-cost paratransit services. The concept of brokerage highlights the new types of roles transportation managers can undertake in today's complex operating environments.

Rural Public Transportation

Rural areas are characterized by sparse populations, often difficult road conditions, and limited resources, yet people in rural areas need mobility for access to jobs, shopping and health care. Most rural people either own autos or rely on informal networks based on them. Public transportation in rural areas has usually been provided solely by social service agencies serving their clients. Federal funding has facilitated the development of systems open to the public but strong local involvement and creativity are needed to create and support such services.

Rural systems have employed many innovations including all types of cooperative arrangements, extensive use of volunteers, and experiments with non-traditional vehicles such as school buses and postal vehicles. Rural public transportation fills pressing needs but due to the difficulties of arranging and financing it, strong local support and creativity are essential.

Public Transportation Pricing

Public transportation pricing systems are composed of fare structures and fare collection mechanisms. Fare structures deal with how much system riders pay to use the service while collection mechanisms range from simple cash fares to complex postpayment and user-subsidy ticket systems.

Planning the pricing of a public transportation service is an integral part of planning the overall transportation system. Fares and collection methods are based on factors such as who the system users are, political considerations, sources of funding, costs of the system, and system service characteristics. Planning pricing systems involves the balancing of many complex demands.

Higher fares often lead to increased revenue generation but they can decrease ridership thereby lowering the social benefits of transit service. Complicated fare systems can promote equity among riders by permitting, for example, discounts for the elderly. However, too many complications can make fares difficult for bus drivers to collect efficiently.

INTRODUCTION TO PUBLIC TRANSPORTATION PRICING

The purposes of this section are:

- To familiarize the student with transportation pricing planning.
- To discuss the history of transportation system financing.

The design of public transportation pricing systems is a complex step in overall transportation system planning. Public transportation pricing systems include fare structures and fare collection mechanisms. Fare levels are set to generate the revenue needed to cover the difference between costs and subsidies. Fare collection mechanisms are the means by which transportation systems collect fares from their riders.

Public transportation receives public support in the form of government subsidies. The reasons for public transportation pricing, therefore, may not be immediately obvious. Public transportation must be priced for the following reasons:

- to meet local matching fund requirements specified by many subsidy programs (see Section 4),
- to ration use of the system,
- to reflect the cost of providing different types of services (see Sections 5 and 6),
- to ensure equity (see Section 2), and
- to achieve community goals, such as reducing traffic congestion.

To meet these goals, transportation planners must gather and analyze data about the local transportation system and the needs of the community. The five key factors are:

- o Ridership Characteristics
- o Politics
- o Funding Sources
- o Service Costs
- o Service Characteristics

Ridership characteristics will be discussed in Section 2. Politics will be discussed in Section 3. Funding sources and Service costs will be discussed in Section 4. Service characteristics will be discussed in Sections 6, 7, and 8.

The Service and Methods Demonstration Program (SMD) of the Urban Mass Transportation Administration (UMTA) has financed a variety of pricing innovation demonstrations

related to fare structures and fare collection mechanisms. These demonstrations have used market segmentation or similar planning approaches. The results revealed alternatives and how they worked, or did not work, in real transportation systems. For example, UMTA discovered through market segmentation analysis that some peak-period (usually 7:30 am to 9:30 am and 4:30 pm to 6:30 pm) riders had flexible schedules and did not need to ride during the peak-period. As a result of these studies and positive results from experiments with fare structure alternatives, many systems have adopted time-of-day pricing to encourage and increase off-peak ridership.

The relative importance of these five market segmentation factors (ridership characteristics, politics, funding sources, service costs, and service characteristics) has changed dramatically throughout the recent history of public transportation.

Transportation pricing systems are directly related to all elements of public transportation services. For example, they help determine users' adoption or rejection of the system. They are an important component of overall system funding. An efficient transit system which meets local needs in a cost-effective and well-promoted manner will include pricing as an integral element of its system planning.

Pricing and Modal Choice

As the out-of-pocket costs that a consumer must pay to obtain the use of the product or service, fares affect consumers' choices, behavior, and well-being. However, trip choice decisions, particularly for potential passengers who have access to a car, is much more dependent on service quality than on price. Price is just one of the attributes that a potential passenger uses in making his or her mode-choice decision. For example, few consumers would be willing to use, let alone pay for, a service which is seldom on-schedule, clean, or safe.

As a source of revenue, fares affect system funding. If the transportation service does not make enough money from fares and subsidies to keep its vehicles in proper repair, breakdowns will cause vehicles to be off-schedule. Since most transportation systems are subsidized, maximizing profits is not a factor in establishing fare levels. Fare levels are therefore based on the need to meet expenses after subsidy expenditures and on public policy which must consider many factors, including but not limited to the following:

- reduction of auto congestion and pollution through the encouragement of maximum public transportation use;
- equity considerations, that is the system's ability to meet the needs of various user groups;

- local support required to match federal and state subsidy stipulations;
- willingness of passengers to pay higher fares for special services; and
- operational constraints such as the disadvantages of various fare collection mechanisms.

Conversely, an inefficient system which does not have wide public support should not treat pricing as a high priority. Basically, a badly planned and improperly targetted system will not benefit from proper pricing until system evaluation and implementation of needs-based planning have been met. One method of needs-based planning is market segmentation analysis which will be discussed in Section 2.

History of Transportation System Financing

Transportation pricing systems are directly related to system finances. At present, transportation systems must take in enough in fares and subsidies to cover costs. Historically, public transportation system finances have followed a four-phase development pattern:

- Phase 1 -- Pre-World War II private interest subsidization
- Phase 2 -- Post-World War II to 1960s public equity-based subsidization

- Phase 3 -- 1970s public interest-based subsidization
- Phase 4 -- Present emphasis on declining government subsidization

While most systems experienced these phases sequentially, they did not necessarily experience them simultaneously with all other systems. For example, some systems remained profitable as much as 10 years after other, usually larger, systems required government subsidization for their continued existence.

Phase 1 -- Pre-World War II

From the turn of the century until World War II, urban transportation systems were profitable and attracted private capital for construction and operation. System owners determined fares on the basis of their costs and the expectation of a reasonable profit. Some private interests, such as real estate investors and utility companies, subsidized system expansion in the hopes of increasing their own profits through expanded land development. The public interest was protected by government regulatory bodies, such as public utility commissions.

Phase 2 -- Post-World War II to 1960s

Declining ridership after World War II can largely be traced to the growth in private automobile ownership and changing patterns of land use. See Illustration 1. As profits declined with ridership declines, many systems became publicly owned and entered a phase in which passengers were expected to pay only for the cost of operation and perhaps make some contributions toward capital costs. This approach was based on a belief that the public interest would be best served by publicly subsidizing fares to continue to meet the needs of specific user groups, such as the elderly, handicapped and disadvantaged.

In this environment, revenue did not exceed or even meet costs and costs soon lost their position as the dominant factor in determining prices. Government subsidy availability became the critical factor in many management decisions including pricing and capital expenditures. This increase in public subsidies greatly increased the role of politics in all aspects of public transportation management. Taxpayers who do not use public transportation systems question how and why their money is being spent on transit. System riders are potential voters who have opinions on community priorities, government spending, and other aspects of transportation services such the fairness of pricing and subsidy levels.

Illustration 1. Developments Leading to Auto Purchase

Phase 3 -- 1970s

In recent years, operating expenses have risen more rapidly than inflation. However, raising fares to levels that reflect operating costs might interfere with other public policies adopted to lessen air pollution, to reduce the need for downtown parking facilities, to reduce traffic congestion, and to encourage energy conservation by promoting public transportation use. As long as the actual costs of operating an automobile are not obvious, it would be counter productive to keep fares at operating-cost levels. For instance, few people count the social costs of time delays caused by traffic congestion when they compare using their cars to taking public transportation. By maintaining fares at levels lower than actual operating costs would dictate in other industries, public transportation systems have aimed to serve the public interest by encouraging reductions in private automobile use.

It is the dual nature of prices that gives rise to a basic conflict in public transportation pricing. To minimize the required subsidy burden, fares should be set relatively high. High prices, however, result in decreased ridership and a consequent reduction in satisfying public interest issues.

Thus transit managers, in their duty to the public, must be concerned about both effects: a budget arguing for higher fares and concern over sustaining ridership levels leading to lower fares.

As a result, most systems entered a third financial phase, in which no attempt was made to have urban users pay the full amount of operating expenses. In fact, the average bus systems in 1983 collected only 37.9% of operating expenses from fares. Larger, metropolitan systems usually collect a greater percentage of their revenues from the farebox than do smaller, urban or rural systems. National, state, and local governments have assumed operating deficits through assistance programs. Federal subsidies for capital investments with many conditions in regard to the type of project to be financed and the size of state and local contribution are now fairly standard.

Phase 4 -- Present

The fourth phase is reflected in the federal government's present emphasis on reducing subsidy grants; such reductions impact on state subsidy levels. The overall impact on public transportation pricing is an increase in market-based fares, more creative system planning, and local funding decisions.

Summary

Pricing systems include fare structures and fare collection mechanisms. Large operating deficits require higher fares; however, hasty rate increases can lower ridership. For all riders, the choice to ride public transportation is based on a variety of factors. Quality of service is more important than price for the vast majority. The federal government's present emphasis on reducing subsidy grants is encouraging more creative system planning and market-based fares.

SYSTEM RIDERSHIP

The purposes of this section are:

- To introduce the student to the importance of market segmentation analysis in pricing planning.
- To discuss the importance of needs-based planning.

Pricing systems cannot be determined in isolation from sound overall system planning. The first question to ask is: who needs the service and why? To answer this ridership characteristics need to be assessed by integrating knowledge about consumer habits, needs, and preferences.

Instead of focusing immediately on transportation systems, the planner should begin by studying the actual mobility needs of the people to be served. Needs-based transportation planning is the only way to ensure services that will be utilized and, therefore, cost-effective. As has been determined by virtually all demonstration and pilot projects (successes and failures), unless a service meets the individual needs of riders, it will not be used.

Market Segmentation Analysis

Market segmentation analysis is one step in an approach to transportation planning by which basic marketing principles are applied to the specific transportation needs of local people to better target public expenditures. The concept of market segments comes from the need to analyze a wide spectrum of consumers or users to determine sub-groups which share similar characteristics or needs.

The four basic steps in market segmentation analysis are:

- Identification of market segments and determination of their needs.
- Assessment of existing services.
- Determination of unmet needs by the comparison of transportation needs and existing services.
- Design of systems targetted to needs.

The major types of information required to assess the transportation needs of various groups in an area are:

- demographic information on the region,
- data on the size of market segments,
- data on travel needs (frequency and timing of probable trip destinations) and characteristics of market segments,
- data on travel attitudes and choices from national and local studies, and

- information on local attitudes towards transportation issues and systems.

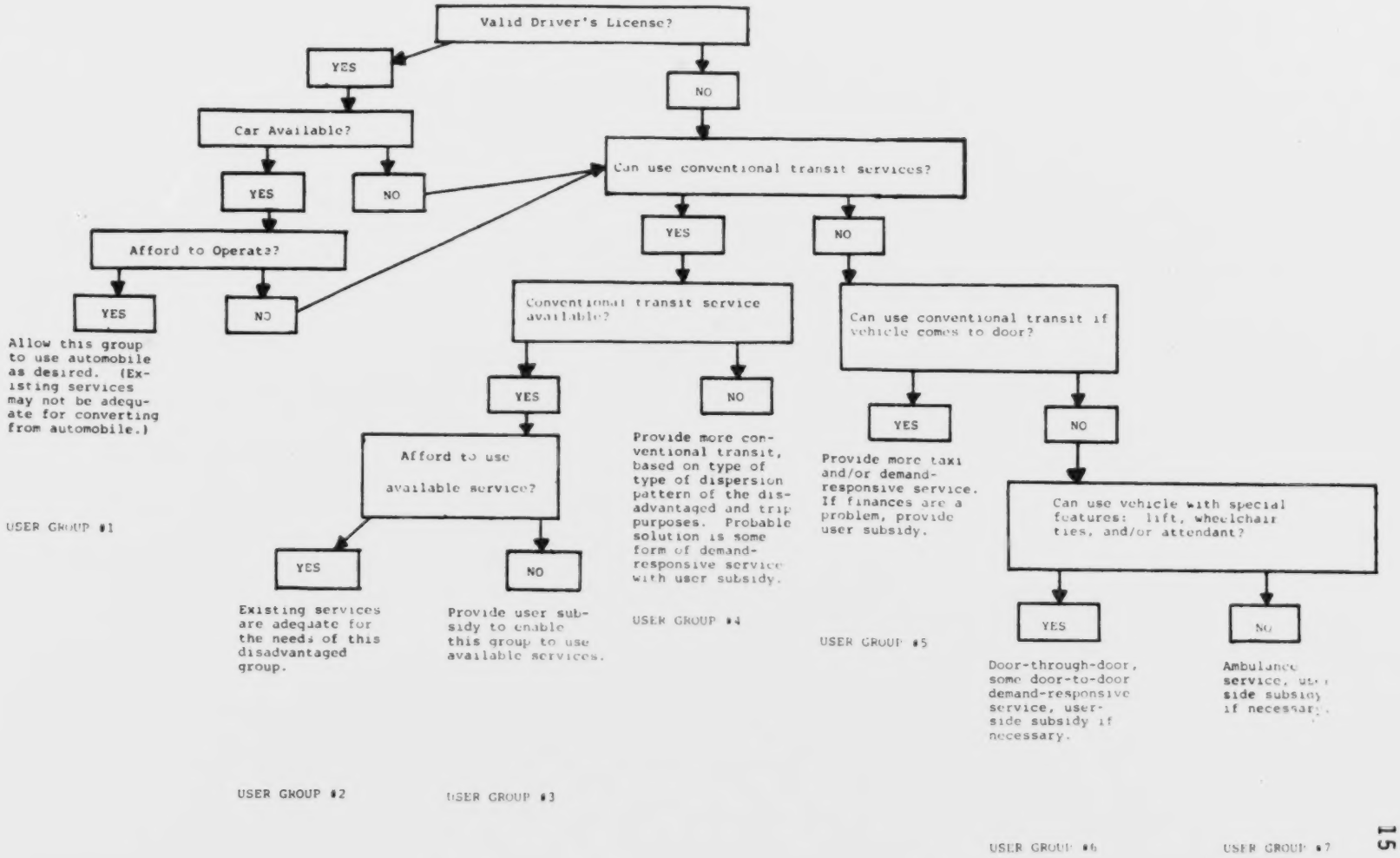
Gathering and analyzing these varied types of data is a complex task. There is no simple recipe for success. It is important to gather information from as many sources as possible to facilitate cross-checking and validation of estimates. It is also important to assess the reliability and validity of the methods used to generate the data.

Once gathered and evaluated, the market segmentation information can be applied to transportation pricing and service planning. Due to the diverse nature of the groups the transportation planner will be attempting to serve, it is very important to integrate service planning and pricing planning. For example, the trip choice decision, particularly for potential passengers who have access to a car, is much more dependent on service quality than on price. Price is just one of the attributes that a potential passenger uses in making his or her mode-choice decision.

Transportation User Groups

Each planner must define local market segments (see Figure 1). Some of the most common user groups fall into the following overlapping categories:

Figure 1. Transportation User Groups Analysis.



SOURCE: National Cooperative Highway Research Program Report #209.

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- Commuters
- Transportation Handicapped
- Transportation Disadvantaged
- Rural Users

Commuters are a significant market segment. They must be able to depend on the transportation system to be reliable and punctual. Factors such as speed, cost, and comfort have a strong influence on commuter travel choices. Frequently, commuters are willing to pay premium fares for premium service. Encouraging commuters to use public transportation as opposed to their private automobiles can reduce traffic congestion and environmental pollution and is in the best interests of the transportation system.

The transportation handicapped are those persons whose physical or mental condition makes it difficult for them to use auto or conventional transit. These people present unique mobility problems while generally being more dependent upon public transportation for necessary trips, such as those for medical care and food shopping. Punctuality is not as important for this group, but door-to-door service is very important as their personal security and limitations due to disabilities can be severe hindrances to mobility; they often cannot get to a bus stop. Elderly members of this group are concerned about security. Meeting the needs of this group frequently

requires special training, equipment, and public subsidies; but it is, nonetheless, an essential consideration in transportation planning. Often door-to-door, demand responsive service is a cost-effective, high quality service for this group.

The transportation disadvantaged refers to those people who have no reasonable transportation alternative for a given trip at a given time. As many as 40% of the American people are regularly part of this group which includes the young, the poor, non-drivers, and many elderly people. They have a wide range of trip purposes and of abilities to pay standard transit fares. They, therefore, represent a large potential ridership for any new or improved transportation service.

Rural users are those who live in low population density areas where travel demand is often too low to support conventional transit service. Yet, this group is composed of members of each of the previously mentioned groups. With careful planning, the needs of rural users can be more effectively met.

Data Analysis

After accumulating the data on local market segments (frequency, direction, and timing of probable trips), that data is evaluated in comparison to the existing system's

services. Then, system modifications and improvements to meet unmet needs are evaluated for feasibility and cost. At this point pricing planning begins. Each element of the transportation system--present system, proposed system, costs, subsidies received, user groups to be served--will impact on the fares which can and will need to be charged.

Assessment of Existing Service

Several quantity-based service measure statistics are commonly compiled:

- Cost per passenger mile
- Miles of transit routes
- Passengers carried per mile or hour
- Passenger-miles per hour
- Amount of service to various user groups
- Annual vehicle miles
- Subsidy per passenger trip

Federal, state and local governments frequently require these statistics when evaluating requests for subsidy grants. Their usefulness, however, goes beyond this. For example, knowing the passenger-miles per hour for a particular bus route could suggest service modifications that would increase ridership. If the 8th Street line carries very few passengers at rush hour and analysis of residents on 3rd Street shows a large number of commuters who would use public transportation if the route were moved

closer, running that route on 5th Street for rush hour runs could give a net increase in ridership. There might be some loss of 8th Street commuters; but as ridership from that street was initially very small, it should be a small loss.

Since financial resources are generally limited and subject to political influence, planners must organize the raw data and make recommendations according to:

- What are the range of transit needs?
- How can the range of needs be met by feasible transit alternatives?
- What is the cost of meeting each of these needs?
- What needs should take priority over others?
- What is the potential for system implementation within the local political context?

See Illustration 2.

As a special focus of overall planning, pricing planners must look at: 1) revenue sources, 2) expenditures, 3) fare structures, 4) fare levels, and 5) collection methods.

User Equity

Fare policies promoting user equity are often vague simply because policy-makers have not defined "equity" uniformly, and the concept is in many ways subjective.

Illustration 2. Transportation Planning

Recent definitions, which have been used to help planners formulate public policy objectives, include equivalent fare per mile and equivalent cost recovery. Older definitions focused on the rider's ability to pay--that is: fares should remain low to allow low income users equal access to mobility. Both definition types imply "fairness" and impact on contemporary implementation of fare policies.

> Equivalent fare per mile means that the fare structure is set up so that each rider will pay a fare that is based on the distance travelled.

For example, if one passenger travels one mile and another travels three miles, the fare for the longer distance will be equal to the amount paid by the first passenger plus the cost of carrying the second passenger the extra two miles. This will not be three times as much as the fare for the one mile passenger because it does not cost as much to carry one passenger three miles as it does to carry three passengers one mile each.

> Equivalent cost recovery means that the overall system will collect fares in proportion to the amount that it costs to provide a certain service.

For example, if after subsidies have been deducted from the cost of servicing a particular area at a particular time, it costs the system $5.00 per hour to run a vehicle along a certain route due to traffic congestion, then the riders along that route must be charged in such a way as to recover that $5.00 cost. Adopting this as a guiding policy leads to complex fare structures as costs vary by route and by time of day.

> Equal access to mobility (or ability-to-pay) concept claims that public transportation is a public service and that fares should be set to favor those least able to pay.

Adopting this as a guiding policy, claim its proponents, is in the best interests of the public because it allows self-sufficiency and public contributions by those who would otherwise be more limited in their acceptance of employment and less able to make contributions to other areas of society. Special fares for the elderly, students and job seekers are motivated by this rationale.

These concepts are not mutually exclusive. Most systems support equal access through special prices for specific groups while basing fares on either equivalent

fare per mile or equivalent cost recovery. An ideal fare policy which could equitably meet the needs of all user groups and recover costs would be impossible to implement, but it is worth striving toward that goal.

In the interest of equal access to mobility, user-side subsidies are frequently offered. These consist of the distribution of reduced-cost tickets or partial payment tickets to those who are identified by social service agencies as among the transportation handicapped or transportation disadvantaged. This is often done in conjunction with a brokerage approach based on matching needs with available resources.

> Brokerage is a management structure. The broker, either as private consultant or civil servant, is paid for matching resources with needs.

The transportation broker can serve as:

- A clearinghouse for users of transportation and providers of transportation services,
- A resource manager concerned with cost-effective and convenient service for the public, and
- An advocate for change of current legal and institutional barriers to better transportation.

Kansas City Share-A-Fare Program

Kansas City's Share-A-Fare user-side subsidy program is a good example of an innovative solution to both needs-based planning and targetted fare policy to improve mobility access for the elderly and handicapped.

The progam offers low-cost, door-to-door transportation through a brokerage project for any Kansas City resident who is over 65 or physically disabled. Transportation service is provided under contract by three not-for-profit agencies, two taxicab companies, one for-profit medical provider, and three city owned and operated vans. Brokerage has eliminated duplicate services, thereby reducing some costs.

Potential participants enroll by applying at one of 24 designated agencies or by calling the project office. Each enrollee is assigned an ID number and issued approximately 25 coupons per issuing period. This varies slightly by agency affiliation. This arrangement allows subsidies to be narrowly targetted. A participant remits one coupon and a reduced fare based on the destination and type of vehicle needed. The fare system is very complex because the affiliated agencies are not fully integrated, but mobility has been enhanced and cost per trip of special riders has been reduced.

Summary

Coordinated transportation planning requires careful ridership characteristic assessment. Needs-based planning must integrate this information with system costs, sources of subsidy, political and logistical restraints, and concepts of equity. Market-based pricing should be tempered with targetted programs to ensure access to mobility.

LOCAL SITUATION ASSESSEMENT

The purposes of this section are:

- To introduce the student to the concept of local impact groups.
- To discuss the potential such groups have for implementing or inhibiting changes in public transportation pricing.

The decision making process with respect to transportation is complicated. Government authorities overlap; pressure groups abound. The controversial nature of fare changes makes achieving political support for pricing policies essential. A small town or village, for example, may block the development of a light-rail system that could benefit an entire region.

Most people and institutions are generally resistant to change. Their ideas and expectations have been formed by previous experiences with public transportation. Seldom will the transportation planner in the U.S. work in an area that does not already have, and never has had, a public transportation system, with the advantages, disadvantages,

and predjudices that come with existing systems. Long before proposing changes to the present system or innovative solutions to meet the needs of specific groups, the transportation planner needs to be aware of legal, regulatory, political, and attitudinal constraints. The planner will find it much easier to implement proposals if community support has been established long before the proposal is made. The only way to do this is to know what groups exist and what impact they may have on the system.

Local Impact Groups

All communities are made up of smaller groups that can influence what the planner can and should do. Each group will have opinions, needs, and desires related to mobility issues. Each will have an impact on services which can and/or should be offered and therefore on the fare structures which can be established or altered. See Figure 2 and Illustration 3.

Merchants in the Central Business District (CBD) will want low fares to encourage downtown vs. mall shopping. Tax payers who do not use public transportation systems will want to know how and why their money is being spent on transit. Commuters will want clean, efficient, prompt services.

Figure 2. Principal Groups Involved in the Transportation Decision-Making Process.

GOVERNMENT	CITIZEN GROUPS	BUSINESS COMMUNITY
Local	Advisory Boards	Chamber of Commerce
County	Fraternal Organizations	Developers
Metropolitan	Homeowners	Labor Unions
Regional	Individuals	Merchants
Special District	League of Women Voters	Newspapers
Transportation Authority	Neighborhood Groups	Taxi Companies
State Department of Transportation	Parent Teacher Associations	Transit Operators
Other State A-95 Agencies	Peace Groups	
Federal Department of Transportation	Religious Groups	
Other Federal Agencies	School Groups	
Law Enforcement	Service Clubs	
Public Safety Agencies		
Welfare		
Health Agencies		

SOURCE: Technology Sharing, 1978, p. 29.

Illustration 3. Principal Groups Involved in the Transportation Decision-Making Process.

Source: Technology Sharing, 1978, p. 29.

Transit employees' unions (usually found in large, metropolitan areas) will be interested in the impact that service changes will have on their members.

Planning and implementing any transportation service that is truly responsive to the transportation needs of a community, and is supported by that community, means involving group representatives from the beginning and throughout the life of the program. Too often services have been planned and put into place without involvement of the users during the planning stage. These services usually failed in an attempt to meet the transportation needs of the community and, thus, failed to survive.

Other services are well-planned with community involvement and a reasonable solution is designed. Salt Lake City's proposed fare-free demonstration shows that things can get out of hand if all concerned groups do not participate in open dialogue from the earliest stages.

Salt Lake City Example

In Salt Lake City an Off-Peak, System-Wide, Fare-Free Demonstration Project was proposed. The proposal was developed without consulting the surrounding rural counties. It was defeated because conflict occurred between urban Salt Lake County and the nearby rural counties over control of regional agencies.

Rural counties were concerned that if the free-fare was successful and continued beyond the demonstration period, resources used to provide lightly patronized, rural services in low-density areas would be diverted to provide free service in urbanized Salt Lake County. The Salt Lake County operating authority, on the other hand, was reluctant to give up a source of revenue not subject to legislative review. A side issue was the offering of fare-free service during hours of travel by school children -- private operators feared that "free" public transit would be used to replace school bus service in some communities. As a result of these conflicts, the project was defeated.

The impact groups in this example are somewhat larger than usual, but the principles are the same. Disagreements should be worked out in planning stages before a concrete proposal is made. Interested groups must be included in planning, and proposals must offer equitable impacts in terms of both user benefits and subsidy usage.

Group Impacts

Pricing of most public transportation services in urban areas is the responsibility of local governments, acting either individually or jointly through metropolitan agencies. To date, local government decisions on public transportation fares typically have been shaped by

short-term political, fiscal, and administrative expediency. Recently, however, growing deficits and stringency in public subsidy budgets have demanded a more comprehensive view of public transportation pricing.

Social service agencies frequently offer transportation services for their clients. When planning fare structures it is important to contact these groups to evaluate how fare and service changes will impact on the agencies and their clients. The planner may well find that a coordination of efforts would be cost effective for the system and practical for the agencies and their clients.

As the Salt Lake City example shows, private transportation providers are a strong potential source for meeting the needs of various user groups and also a strong potential source of conflict. Providing a chance for input from these groups can divert conflict and offer possible solutions to planning difficulties.

Once the planner has evaluated the interests of these groups (and others) and established a supportive environment for change, fare structure planning can focus on evaluation and acquisition of external (other than farebox) funding.

Summary

The controversial nature of fare changes makes achieving political support for pricing policies essential. Local impact groups have tremendous potential for implementing or inhibiting changes in public transportation pricing. The public transportation planner must be aware of the interests of these groups and try to gain support for the system.

STUDENT REVIEW

1. List the five key factors used to determine pricing levels and discuss the importance of two of them.

2. Discuss the four phase history of transportation system financing.

3. What types of information are used in market segmentation analysis? Why is this information important in public transportation planning?

4. Discuss concepts of user equity, such as: equivalent fare per mile, equivalent cost recovery, and equal access to mobility. What are the impacts of implementing fares based on each concept for a commuter and for an elderly woman living alone?

5. Define "local impact groups" and list three examples. Visit a leader of one of these groups in your area and discuss local public transportation services.

6. Why is it important to achieve political support for pricing policies?

GUIDELINES FOR STUDENT REVIEW

1. See pp. 2, 14-16, and 26-30.

2. See pp. 5-10.

3. See pp. 13-18.

4. See pp. 21-23.

5. See pp. 27-31.

6. See pp. 26-27 and 30-32.

FUNDING SOURCE ANALYSIS

The purposes of this section are:

- To explore the major sources of transportation funding.
- To discuss the role of funding considerations in the pricing process.
- To illustrate the complexity of funding sources for public transportation.

Public transportation pricing depends greatly on evaluation of a system's entire financial situation. For simplicity, one may state that a viable public transportation system requires revenues plus subsidies that are greater than or equal to the costs of operating and replacing equipment. Figure 3 lists many of the potential sources of subsidy.

Federal Government Support

The U.S. Department of Transportation (DOT) spends about one billion dollars each year for urban public

transportation operations. U. S. DOT funds are made available in three major ways. The first type is formula matching grants in which the amount is predetermined for each state and metropolitan area and must be matched by local funds. Second are discretionary matching grants which are allocated based on UMTA review of individual applications. These grants require matching funds. Third are discretionary demonstration project grants which are fewer in number but have the advantage of requiring little or no local matching funding.

Federal government subsidy programs offer a myriad of potential financing. One step in evaluating these subsidy sources is to maintain current information about federal and state regulations which effect programs which will in turn affect the system budget. For instance, the 1982 Surface Transportation Act required public transportation systems to commit 10% of all contractual opportunities to disadvantaged minority-owned business enterprises and 1% to women-owned businesses.

State Transportation Assistance

Each state will necessarily have its own means of collecting and distributing transportation funds. Many states have specific revenue sources which are dedicated to

Figure 3

Potential Urban and Rural System Subsidy Source

- Federal government subsidy programs
- State funds
- Local city/county governments
- Health department
- United Way
- CETA/Jobs Bill
- Title XX
- RSVP
- Foster Grandparents
- Fares/donations/volunteers/service clubs
- Interest on money
- Charter/rentals
- Xerox/machine fees
- Maintenance contracts
- Leased space

SOURCE: 6th National Conference on Rural Public Transportation, Workshop Proceedings.

funding public transportation. For example, the planner may need to look into such dedicated state subsidy sources as:

- Arkansas' Private Corporations Tax. An additional $3 per year is collected from all private corporations and is then administered by Arkansas' Department of Transportation. It is distributed to all elderly and handicapped transportation assistance recipients.
- Montana's Gas Revenue Tax. This is a state sales tax on gasoline. $75,000 of this money goes to cities with public transportation systems and $75,000 goes to each county.

Urban Transportation Assistance

In 1975 regulations were issued jointly by UMTA and the Federal Highway Administration (FHWA) to establish a regulatory basis for the consideration of all transportation modes. These regulations provide that the governor of each state designate a Metropolitan Planning Organization (MPO) for each urbanized area in the state. The MPO is intended to be the forum for cooperative decision-making by principal elected officials of all local governments who will have representation on the MPO board.

The MPO is responsible for coordinating the preparation of certain basic informational materials to assure

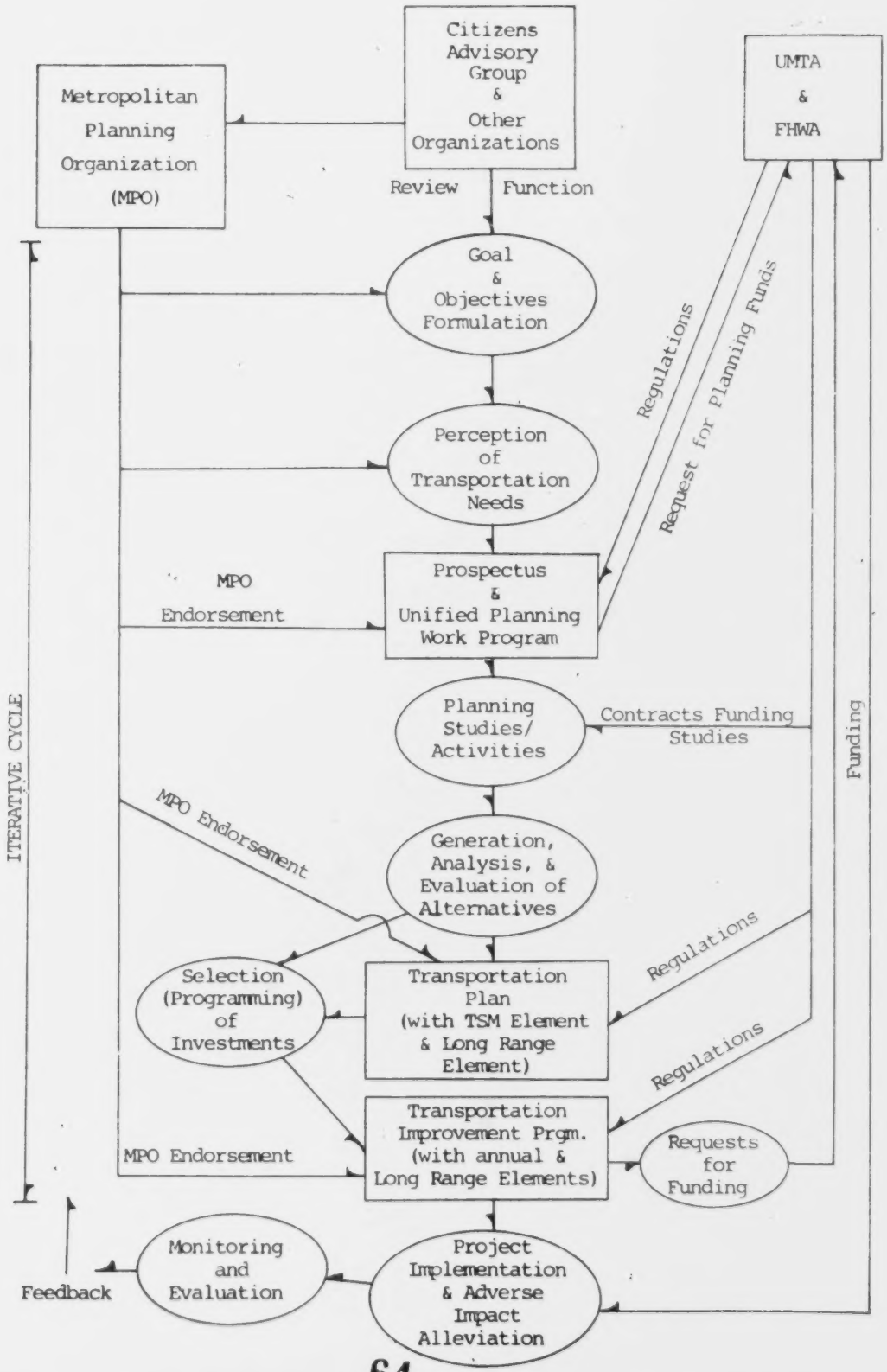
eligibility for federal assistance. The federal "certification process," in which this documentation is reviewed as a precondition to federal assistance, serves to ensure that the region seeking funding has fulfilled certain process-oriented requirements. These requirements apply to all urban areas seeking FHWA or UMTA assistance.

The major influence of the MPO comes from its potential control over federal aid. Real control varies by state and metropolitan area. Frequently states contract other agencies to control state and federal funds, and the MPO is merely a planning agency whose approval is necessary. Funding is divided by purpose, such as funds for planning versus funds for operations and maintenance. As can be seen in Figure 4, the MPO process is very complicated..

As a result of various moves toward more local participation in the trasportation planning process, the state's role consists of the following:

- the governor designates the body that will be the MPO and whether the MPO or some other state government agency will control the incoming federal aid.
- the State allocates planning funds:
  -- Highway Planning and Research (HP&R) funds go directly to state transportation agencies for statewide highway planning and metropolitan transportation planning.

Figure 4. Role of The MPO



Source: Taxis, The Public, and Paratransit: A Coordination Primer, 1978, p.78

-- Metropolitan Planning (PL) funds are allocated to a state on the basis of the ratio of the population of urban areas in that state to the total urban population in all states. It is then up to the state to determine a formula by which its allocation is divided among local MPOs.

Rural Transportation Assistance

Federal support for public transportation began with the passage of the Urban Mass Transportation Act of 1961, but it was ten years before non-urban area needs were given official notice.

Federal funding sources most commonly used by rural transit systems are at least as complicated as urban funding sources, as illustrated in Figure 5. Unfortunately, rural systems often do not have the time and money to fully investigate all of the possible options.

In the National Transportation Act of 1974, Congress specified that, "up to $500 million" over the next five years was to be available for non-urban (areas with less than 50,000 population) transportation projects. Unfortunately, the reality proved far less than the promise as no more than $30 million of these funds were actually spent.

Figure 5

Federal Funding Sources for Rural Systems

- Section 18
- Section 16(b)(2) of the UMTA Act
- Title IIIC of the Older Americans Act
- Title XIX of Social Security Act (Medicaid)
- Social Services Block Grant (formerly Title XX)
- Section 9A of the UMT Act
- Section 3 of the UMT Act
- Title IIIB of the Older Americans Act
- Title V (Headstart)
- Section 5 of the UMT Act
- Developmental Disabilities
- Title I of the Rehabilitation Act

SOURCE: 6th National Conference on Rural Public Transportation, Workshop Proceedings.

Such legislative action, however, started the momentum. In 1978, Congress took a major step in the direction of rural equity: It enacted Section 18, a formula-grant transportation program for non-urban areas. Unlike the various social-service programs that funded specialized transportation for the elderly and handicapped, Section 18 was aimed at providing public transportation. Under the law, a specialized provider could receive Section 18 funds, but only if it was available to the general public as well.

West Virginia provides a good examples of how Section 18 funds can benefit small and rural operators. West Virginia conducted a survey of all paratransit and taxi providers in the state, a performance audit for small urban and rural transit systems, and a statewide self-help marketing program. By encouraging better integration and organization, it is hoped that costs can be lowered which will also, hopefully, lower fares.

Local Matching Fund Requirements

Most federal funding programs require a percentage of local matching funds. Therefore, planners must consider ways in which to raise that revenue. According to some experts matching fund requirements are probably the most important reason for transportation pricing, otherwise there would be more free systems. Generally raising

matching funds is easier for urban system planners than for those in rural areas. Urban systems usually have ready access to city and state appropriations. Creativity is required of system planners in small urban and rural communities.

The Voluntary Action Center of DeKalb County, IL (TransVAC) provides transportation service to the elderly and handicapped, and also been made accessible to the general public in rural areas. A substantial portion of the revenue generated at TransVAC comes directly from the sale of advertising space on agency vehicles to local businesses.

Funding Trends and Creativity

Cuts in federal and state support for small urban and rural transit systems have resulted in innovative solutions to filling the gap between need for public transportation and available service. Urban areas are increasingly turning to paratransit systems, employment-based vanpool organizations and ticket distribution, and private taxi company contract involvements. These innovations have created a need for more varied and complex pricing arrangements.

Rural public transportation systems offer imaginative solutions to reducing costs which in turn impact on the

fare level requirements. Such solutions include the use of volunteers, the coordination of existing services, and the use of non-traditional vehicles, such as school buses and postal transport vehicles.

OATS--Creative, Integrated Funding Planning

The origins of what is now known as OATS (formerly, Older Adults Transportation Service) began in the 1970's when a small group of older persons in central Missouri recognized the unserved needs of an increasingly elderly population in the state. As is common in rural areas, the younger Missourians tend to shift to the urban areas in search of employment, leaving an increasingly older population behind.

Recognizing that profit incentives were insufficient to support an effective rural transportation service addressed to the elderly and disabled, a group of older citizens turned to the idea of a transportation cooperative. This organization was called the Cooperative Transportation Service (CTS).

With initial funding from the state's Office on Aging and technical assistance from the University of Missouri's Extension Division, CTS purchased three vehicles and hired a staff of five. Demand-responsive service was offered in 8 counties in central Missouri.

CTS proved to be a popular service because it met a genuine need and appealed to its users who exercised a voice in providing and controlling the service. CTS became the Older Adults Transportation Service (OATS) in 1973.

Funding for OATS is provided by:

- purchase-of-service contracts with eight area agencies on aging,
- funds from social services block grants and the Older Americans Act,
- contracts with the Missouri Highway and Transportation Department for federal transportation funds,
- state Department of Mental Health, and
- subcontracts to coordinate services.

About 15% of the OATS budget is generated through rider donations and fund raising efforts.

Summary

Funding is the means by which publicly supported services obtain the resources to survive. Despite the complexity, it is necessary to understand and comply with the public's requirements to use its money. Diligence and creativity are needed to keep a system financially afloat and pricing for most services depends first on the relationships between costs and funding.

SYSTEM COST ANALYSIS

The purposes of this section are:

- To discuss typical public transportation systems costs.
- To discuss the relationship of system costs to pricing.

Typical System Costs

Every transportation system will have to take in money to cover certain similar costs. System vehicles may be buses, taxis, vans, or a combination; maintenance may cost more for a vehicle that uses less fuel. These are the kinds of costs that will impact on the overall budget. A sample budget is given in Figure 6.

The following list includes some of the more typical system costs. Individual systems may well need to consider additional items.

1) Labor
2) Capital: Rolling Stock and Building
3) Transportation: Operations and Maintenance

Figure 6: Sample System Operating Budget

FY 86 PROJECT BUDGET

(1) TOTAL NON-OPERATING EXPENSES (Itemized)

Manager's Salary	$ 22,102
Secretary's Salary	-0-
Staff Salary Other	15,435
Fringe Benefits	13,873
Audit Costs	3,500
Board Expenses	975
Contractual Services	5,300
Garage/Storage Costs	5,500
General and Administrative	275
Insurance - Other (Specify)	1,605
Marketing	9,000
Office Equipment	-0-
Office Maintenance	290
Office Supplies	1,400
Printing/Copying	1,500
Rent	3,750
Taxes	380
Telephone Services	3,600
Travel	5,100
Utilities	4,000
Vehicle Insurance	30,000
Other (Specify)	1,250
TOTAL NON-OPERATING EXPENSES	$ 128,835 (1)

(2) TOTAL OPERATING EXPENSES (Itemized)

Drivers Salaries	$ 143,911
Dispatcher' Salary	-0-
Mechanics Salaries	29,135
Fringe Benefits	51,493
Contracted Vehicle Maint. Svcs.	-0-
Fuel	71,000
Hand Tools	600
Licenses	-0-
Oil	1,350
Replacement Parts	20,000
TOTAL OPERATING EXPENSES	$ 317,489 (2)

(3) TOTAL PROJECT COST (Line 1 plus Line 2) $ 446,324 (3)

(4) LESS FAREBOX AND OTHER REVENUE (i.e., CONTRACTS WITH OTHER AGENCIES AND OPERATORS

REVENUES

Farebox Cash	$ 99,623
Farebox Tickets	8,820
Contracted Revenue	4,184
Other (Specify)	453

TOTAL FAREBOX AND OTHER REVENUE APPLIED AGAINST ELIGIBLE EXPENSES $ 113,080 (4)

(5) NET PROJECT COST (Line 3 minus Line 4) $ 333,244 (5)

(6) TOTAL NET PROJECT COST FOR SECTION 18 PROGRAM $ 333,244

(7) FEDERAL SHARE (Section 18; 50% of Line 6) $ 166,622

(8) LOCAL SHARE (50% OF Line 6)

A. CASH MATCH

a. Local Cash	$ 19,622
b. Charter Profit	2,000
c. Advertising Profit	5,760
d. Other (please specify) Interest Income	1,200

B. LOCAL CASH
a. State Funds: $138,000
b. Local Government: $ 19,622 + b + c + d = $ 28,582

Source: State of West Virginia, Public Transportation Division, Sept. 1985.

4) Administration

5) Marketing and Planning

Labor and benefits costs include: salaries for drivers and other staff, vacation time, sick time, retirement and any other benefit costs. To forecast how many drivers a system needs, one must know what variables most closely affect the number of drivers needed. The planner needs to forecast future levels of service to be offered, this is just one of the places where the elasticity calculations to be discussed in Section 6 are helpful.

Capital expenses include: rolling stock (vehicles and special equipment) and building (garage and offices). The cost of rolling stock will be determined by many factors: fleet size as determined by community size and population to be served, fleet mode (standard bus, mini-bus, multi-modal, etc.). Depending on geography and/or the market segments to be served, special equipment may be needed (wheelchair lifts, lift platforms, tire chains or other road or passenger safety equipment, etc.) An operations and maintenance building must be purchased or leased. Each of these options has costs and savings that must be evaluated.

For example, purchasing a building permits direct control over its maintenance, but leasing the building may permit lower total costs if a private owner can pass on tax benefits in the form of lower rents.

Transportation costs include: operating costs and maintenance costs. Operating costs include: fuel, oil, and tires, etc. Fare collection methods and fare levels directly impact on costs. For example, as fare levels approach and exceed one dollar, cash payment--presently the dominant method of fare payment--becomes more expensive due to the difficulty of handling paper money. Alternative fare collection methods require varying proportions of the operating budget for items such as printing of tickets, on-vehicle equipment to read magnetic passes, and so on.

Maintenance costs include: repair parts and labor, and probably a large investment in specialized repair tools. Loss of revenue, customer dissatisfaction, and disruption of service from vehicle breakdowns are also costs attributable to maintenance. Putting a dollar figure on these indirect costs is tricky. The cost of losing customers or of a service disruption is real and such factors must be dealt with constantly.

Administrative costs include: utilites, telephone service, insurance coverage, office supplies, to name just a few.

Marketing costs include: advertising and promotional activities. Marketing should be used to encourage and increase ridership, to announce new services, and to keep the public informed and supportive of ongoing services. It is one expense no planner can ignore. This expense must be

reflected in both budget planning and fare structure. For example, a system that uses an employer pass distribution system is actually advertising its services at the workplace. This might just be the most cost effective, narrowly targetted advertising for a community with mostly large, densely located employers. Thus the fare collection mechanism becomes a means of advertising which could lower fares overall by increasing convenience to commuters, and increasing ridership. See Figure 7 for a typical distribution of transit marketing costs in small urban and rural areas.

Planning expenses include: consultants fees for long- and short-range system forecasts; investments planning; and subsidy source research; and evaluation and forecasts of on-going personnel needs.

Relationship of System Costs to Pricing

System cost analysis should be an integrated step in fare structure planning. A change in fares or services is likely to lead to a change in both ridership demand and system costs. For financial planning purposes, the impact on overall costs is of primary interest.

For instance, a system wishing to expand its services (reduce waiting times on a particular route, perhaps) has several options:

Figure 7

Typical Distribution of Transit Marketing Cost
in Small Urban and Rural Areas

Salaries	61%
Consultant Services	5%
Printing Materials	19%
Advertising	7%
Merchandising	4%
Other Direct Expenses	4%

Note: Marketing expenses averaged 3-5% of typical system operating costs in the late 1970s.

SOURCE: Public Transportation Needs Study for the Low Density Areas in a Five-State Region in the Midwest. University of Kansas and UMTA, 1981.

- use existing resources more intensively, perhaps only temporarily;
- reallocate resources internally, taking vehicles and drivers from other routes;
- acquire extra resources, perhaps from government subsidy sources; or
- contract with an external company to provide the desired service increase.

The actual costs of each of these approaches differ, and so do the types of costs that are relevant. The purchase price, for example, of a new vehicle is very important when the system needs to be upgraded or expanded, but vehicle prices are not important to an internal reallocation of resources. Operating costs are also influenced by geography, traffic conditions, union agreements, and other factors.

Summary

System cost analysis should be an integrated step in fare structure planning. The impact of any one element on overall costs must be assessed. Typical system costs are: Labor; Capital -- Rolling Stock and Building; Transportation -- Operations and Maintenance; Administration; and Marketing and Planning. Pricing revenues must meet the difference between system costs and subsidy funding.

STUDENT REVIEW

1. List and discuss the major sources of system funding.

2. Interview the budget director of a public transportation system about the funding sources upon which the system depends. Include questions about how often the budget is re-evaluated, how far in advance funding sources must be approached, what percent of system revenues come from such sources, etc. Report on the interview to the class.

3. List and discuss typical transportation system costs.

4. List changes a system can use to expand services. Discuss, in detail, probable budget cost increases and decreases.

GUIDELINES FOR STUDENT REVIEW

1. See pp. 36-46.

3. See pp. 48-53.

4. See pp. 53-55.

FARE STRUCTURES

The purposes of this section are:

- To introduce the concept of elasticity and to discuss why it is a useful tool for transportation planners.
- To discuss types of fare structures, and how they are designed and chosen.
- To discuss intermodal and bus system transfer policies and their impacts.

Seldom will the transportation planner be planning a whole new system or completely changing an existing fare structure. Most communities have some form of public transportation in operation, and the planner's job will usually revolve around evaluating the present system and then planning improvements. The planner's first step will generally be to evaluate the existing system--fare structures, service levels, and their interrelationship.

If, for example, a community has decided to incorporate a brokerage operation to meet the needs of the community's transportation disadvantaged, then the planner/broker will

need to know what the present transit, paratransit, private and social service agency-provided transportation services are charging and offering. After accumulating that information the planner will need to estimate what impact fare changes will have on ridership and, therefore, on revenues. Elasticity is one widely-used analytical tool.

Demand Elasticities

The demand for public transportation is influenced by many factors, including the level of fares, the quality and frequency of service provided, and other factors outside the planner's control. Elasticity is a concept used to describe the relationships among these factors. See p. 63.

Elasticities are derived from observed changes in ridership and are estimated from cross-sectional (market segmentation and service analysis) data during the planning of transportation services and service modifications. They are applicable in the following situations:

- estimating ridership for a replacement service that will result in only moderate changes in service quality;
- adjusting analogies to account for differences in service or operation; and
- estimating ridership response to proposed changes to an existing community transit service.

The application of elasticities in planning transportation services, unfortunately, is not straightforward for a number of reasons. First, so-called "typical" elasticities found in standard reference sources are based on fare and service levels, and changes in these levels, observed during the 1960s and 1970s. As a result, they should be used with caution in estimating responses to conditions that will vary radically from conditions typical of those decades.

Second, many of the typical elasticity values, such as walk and ride time, are derived from model calibrations. These elasticities need to be used with caution because they do not adequately cover differences among people in different parts of a region or service differences within a region. More importantly, the elasticities presented in tables largely are based on changes in regular bus route service, and may not be directly applicable to community transit modes. For example, ridership response to a change in wait time may be less for a dial-a-ride service than for a fixed-route service because patrons can wait at home.

The fare elasticity of demand is a useful concept in transit fare planning since it indicates the responsiveness of ridership groups to fare changes. For example, experience has shown that off-peak, short-distance, and shopping trips are more responsive to fare changes than peak-period, long-distance, and work trips. The larger the

Elasticity of Demand

The fare elasticity of demand is a ratio of the percentage of change in demand (ridership) divided by the percentage change in fares.

For example, if fares are increased from 50 cents to 60 cents and ridership decreases from 2,000 to 1,900, then:

$$\text{Point Elasticity} = \frac{\%\ \text{Change in Ridership}}{\%\ \text{Change In Price}}$$

$$= \frac{-5.0\%}{+20.0\%}$$

$$= -.25$$

Therefore, when prices increase by 20%, ridership decreases by 5%, giving a fare elasticity of demand of -.25; or for a 1% fare increase, ridership will decrease by ..25%.

Note: This is the simplest formula for fare elasticity. More detailed and reliable calculations are beyond the scope of this text.

absolute value of the fare elasticity, the more responsive the group. For instance, off-peak riders with a fare elasticity of -0.60 are more responsive to fare changes than peak riders with a fare elasticity of -0.30.

The rule-of-thumb to remember with fare elasticities is that if the elasticity calculation results in a value less than -1.0, a revenue loss will result. In this instance, demand is said to be 'elastic'. If the result is greater than -1.0, a fare increase will increase total revenue, and the demand is said to be 'inelastic'.

Because of the way elasticity is defined, it can be used to estimate ridership changes resulting from increases and decreases in fares. Recall, however, that ridership is affected by many factors--market segments, type of service, etc.--in addition to fares. Changes resulting from a fare increase may be offset by improvements in service or changes in service. For example, in 1979 Honolulu established a prepaid bus pass program which, in combination with other factors, helped to reduce the impact of a simultaneous $.25 fare increase on frequent riders. As a result the system did not experience any noticable reduction in patronage.

Types of Fare Structures

Following evaluation of the existing system, the transportation planner will attempt to select fare structures that will improve the present system. Unfortunately, no simple rules exist for selecting fare structures. Planners need a clear understanding of the present system's limitations, of the changes that are possible within the region and of what is politically feasible.

Fare structures may be simple, complex and/or integrated. In practice, most systems use some combination of options. These combinations strive to deal with the necessary trade-offs between efficiency and equity. Simple structures are extremely efficient, but do not address equity issues. Integrated, market-based structures can be narrowly targetted to specific market segments, but they are also complicated and inefficient (for example, they slow boarding times as drivers must check each passenger's fare). Fare structures may be applied differently to different phases of the transportation system or applied uniformly over the whole system. Listed below are a few of the basic fare options:

- Flat Fares
- Distance-Based Fares
- Time-Based Fares
- Quality-Based Fares

- Special User Fares
- Promotional Fare Policies
- Fare-Free Promotions

A related issue on fixed route systems involves transfer policies. These will be discussed following the fare structure discussions. Also, see Figure 8.

Flat Fares

A flat fare pricing structure maintains the same cost for a transit trip for all riders regardless of the description of the rider, the time of day, or the distance of the trip. Flat fares are prevalent throughout the transit (bus) industry. Flat fares are easy to collect and control, have less potential for fraud, and are easily understood by the public.

However, during the last decades, there have been several attacks on the use of flat fares. Pittsburgh, Los Angeles and Philadelphia, in particular, have taken their cases to court. Their positions were based on the alleged inadequacy of flat fares as revenue-producing systems and on the unfairness and inequity inherent in flat fares with their bias against those segments of the population with less ability to pay,such as the poor, minorities, midday and off-peak riders, and inner-city riders. In addition, critics of flat fare systems argue that the usually more

affluent long-distance riders pay a smaller share of their trip costs.

Some critics of flat fare structures claim that flat fares, by ignoring differences in elasticities of traveler responses to fare changes, raise less revenue with greater sacrifice of trips lost than would be the case with distance-based or time-of-day fare structures.

On the positive side, however, flat fares are easy to administer. Time-of-day and distance-based fares require driver training and a more conscious effort on the driver's part to supervise the payment of correct fares. Flat fare systems also result in faster boardings than do more complex fare systems.

Distance-Based Fares

Perhaps the most common alternative to flat fares is to charge users in some proportion to the distance travelled. Distance-based fares are very popular in light commuter rail and taxi systems. Distance-based fares can be rationalized on the grounds that the marginal cost of servicing long trips is greater than the marginal cost of servicing short trips. In addition, long-distance riders tend to be less responsive (show lower elasticity of demand ratios) to fare change than short-distance riders.

Figure 8

FARE STRUCTURE ALTERNATIVES AND
THEIR BASIC FEATURES

Fare Structure	Basic Feature
Flat Fare	One fare for all trips.
Distance-Based Fare	Fare depends on distance travelled.
Time-Based Fare	Fare depends on the time when the trip is taken.
Quality-Based Fare	Fare depends on the quality of the service provided.
Special User Fare	Fare depends on the client group or other trip category.
Transfer Charge	Additional charge for transfers made.

There are essentially two ways of charging users according to the distance travelled. The first is to identify the rate at which riders should pay for each mile or group of miles travelled. This method, known as graduated fare, is very difficult to administer without the aid of computerized fare collection equipment. Graduated fares are most common on modern commuter railroad and rapid rail systems. The second, and more common, method of charging fares by distance traveled is to superimpose a zone structure on the transportation network. The price of a trip depends on the number of zones crossed. Such a zone structure can be designed in many ways. In 1983, some form of zone system was used by 35.9% of all US transit systems.

One common example of a zone structure can be seen in the way that tolls are handled on turnpikes. While this is not precisely the same sort of thing as taking a bus, the zone structure is easy to understand. If you enter a turnpike at the 3rd entrance and leave at the 5th, you will be charged for crossing 2 zones. This structure applies the principle of equivalent cost recovery to ensure equitable cost value among patrons.

The most common approach to zone structuring in large cities is to design a series of concentric zones, with the center at the Central Business District (CBD). If this zone is too large and the number of external zones too small, this type of zone system is more like a flat fare

structure and is not a true distance-based fare structure. The finer the zone structure, the more equitable the fare structure will be to the rider, but it will be more difficult to administer. See Illustrations 4a, 4b, 4c, and 4d.

The strength of the concentric zone structure lies in its application to a system where the route pattern is largely radial. If, however, there are a significant number of crosstown routes, users on such routes are likely to pay less for a given distance travelled than those who use the radial services. An additional weakness of the concentric zone system is that riders who take short trips across zone boundaries will pay for trips at a much higher rate per mile than those travelling comparable distances wholly within the limits of a zone. This problem can be alleviated by creating minimum fares good for at least two zones of travel; assuming there are many zones, this will not risk the inequity inherent in flat fare structures.

Because of its ease of administration and its pricing peculiarities, the concentric zone system adopted by the Dallas Transit System (DTS) may be of interest. Transit fares in the Dallas 3-zone system are based on where the passenger boards and alights and not specifically on the distance travelled. Thus, a passenger boarding in the outermost zone pays the highest fare, regardless of whether the patron travels to the CBD, the 2nd zone, or only within

Illustration 4a. Sample City Map for Overhead Projection.

Illustration 4b. Equidistant Concentric-Zone Structure Overlay.

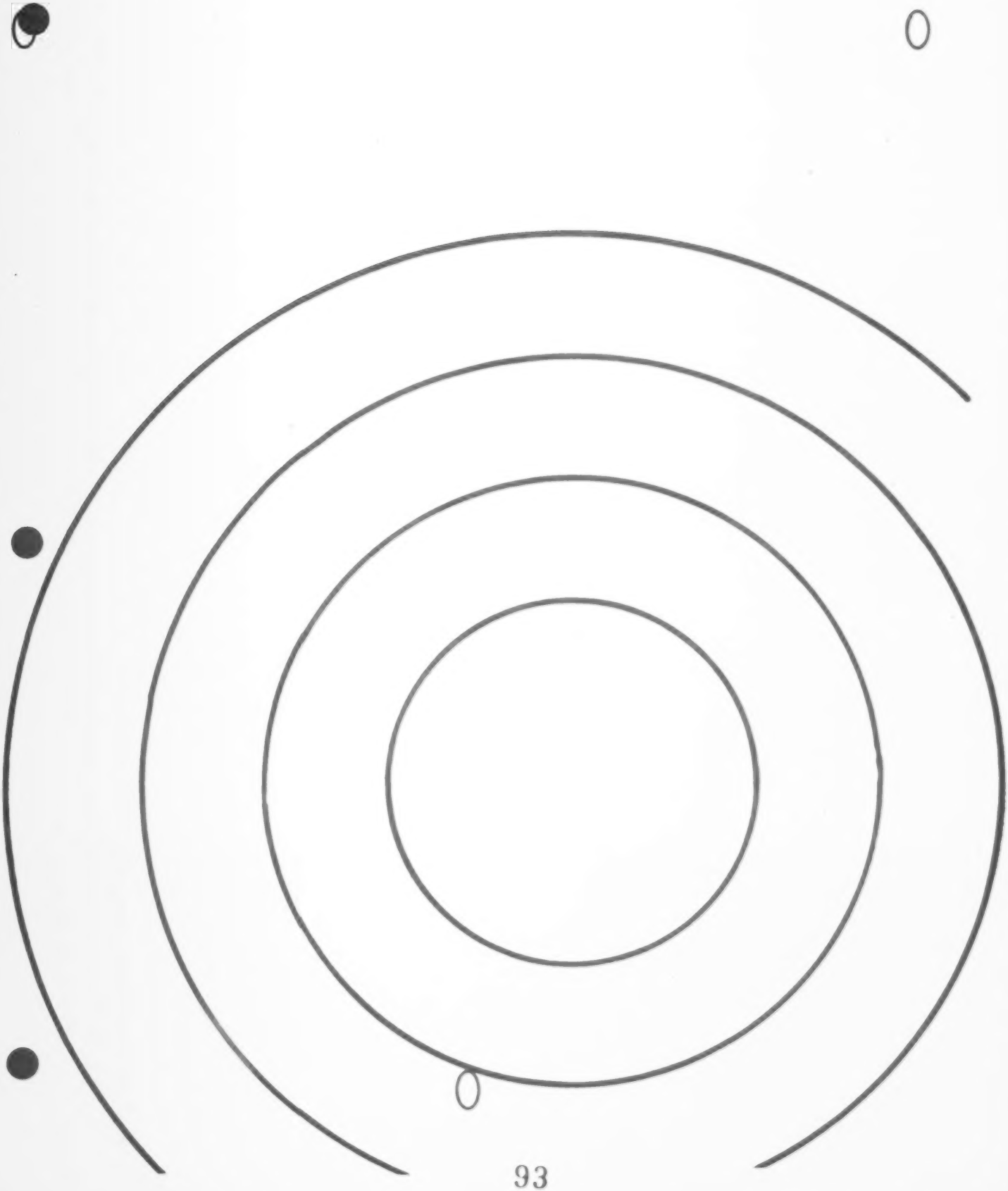


Illustration 4c. Irregularly Spaced Concentric-Zone Structure Overlay.

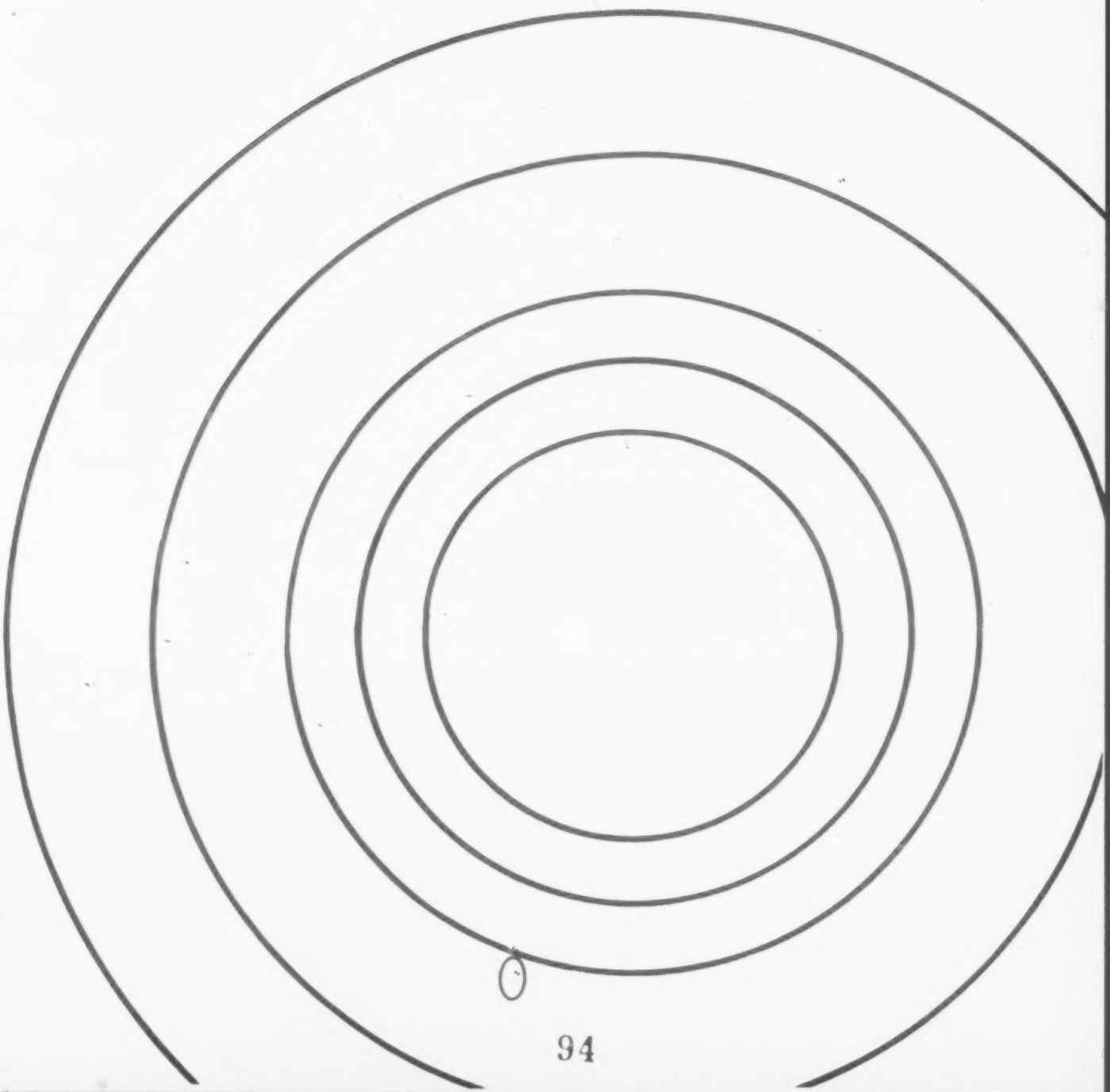
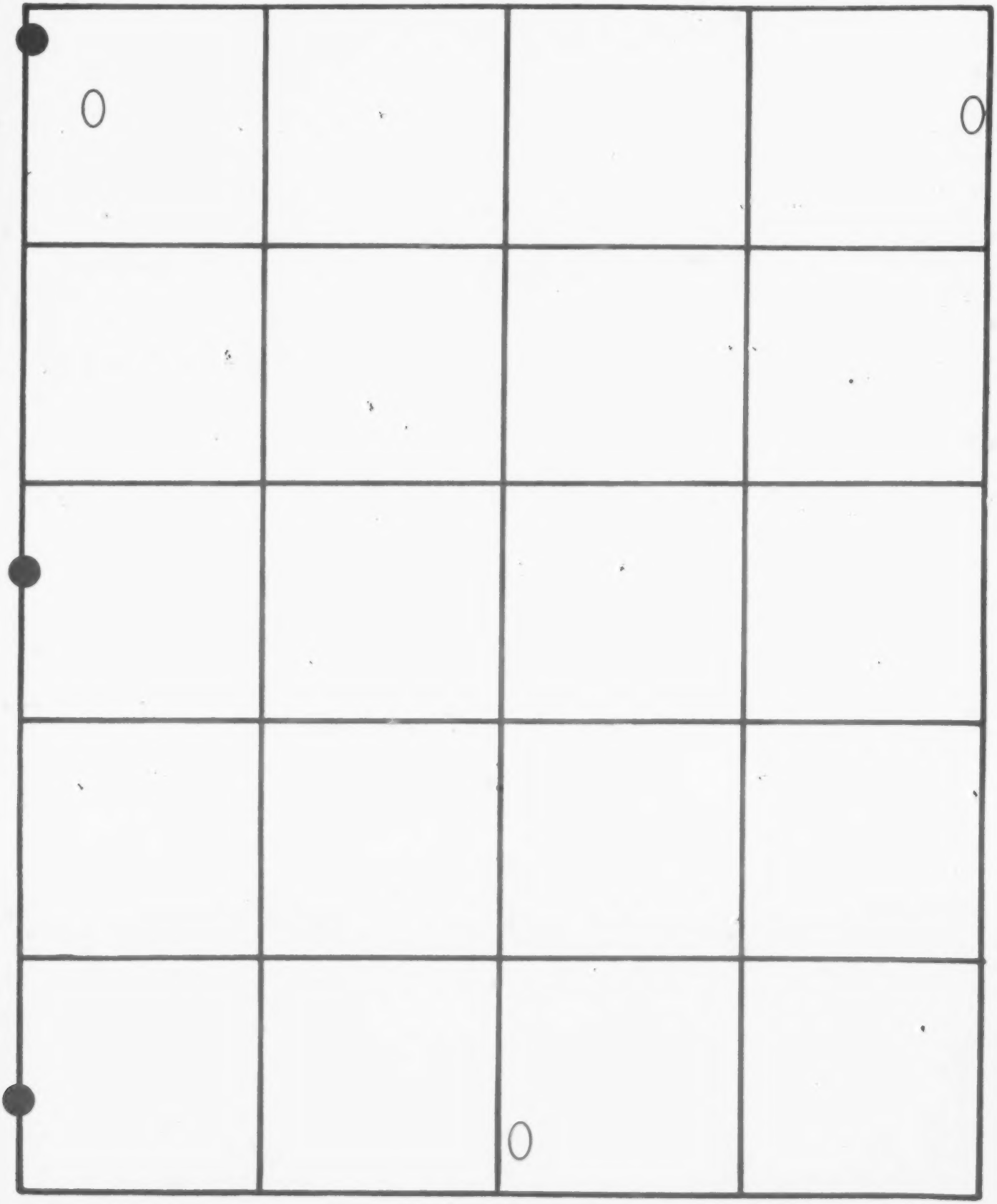


Illustration 4d. Grid Pattern Zone Structure Overlay.



the 3rd zone. A passenger boarding in the center zone pays the fare applicable to the zone where he disembarks. The Dallas fare structure is therefore easy for passengers to understand and drivers to enforce. The structure is based on the premise that service to outlying areas is most costly to provide, trip lengths are the longest for 3rd-zone patrons, and 3rd-zone riders exhibit the lowest sensitivity to higher fares.

An alternative to the concentric zone concept is to superimpose a grid system over the system network. The strength of a grid arrangement is to produce a fare structure that is more equitable for all trip distances, irrespective of whether the rider is using a radial or crosstown service. The grid zone concept's greatest weakness is its complexity.

Finally, it is possible to design a zone fare structure for individual routes, if there is little transferring from one route to another. The strength of a system of individually tailored zones for different routes is that each route's zones can be designed to achieve a high degree of cost equity among users and a maximization of revenue-earning miles. Unfortunately, a system of unique zone boundaries is both difficult to enforce and to understand. This, again, points up the need for a careful evaluation of the efficiency/equity tradeoffs to be built into the system.

Time-Based Fares

A time-based fare structure is one in which the fare paid varies with when the trip occurs. As with a distance-based fare structure, the rationale for time-based pricing involves both cost and market considerations. During peak periods, for example, the cost of providing a transit trip is approximately 50% higher than during off-peak hours due to increased dwell and drive times which cause higher gas usage. Peak riders tend to be much less sensitive to price changes than off-peak riders. By keeping the same average fare, a system can shift from a flat fare to a peak-period surcharge and increase revenues. In 1977 peak-period surcharges were used in only 3.7% of urban transit systems, but by 1983, this figure had risen to 8.9%.

Although time-based fare structures are operationally easier to implement than distance-based fares, time-based fares do create a problem of enforcement for the vehicle driver. Often, passengers will argue with the driver over the correct fare when boarding takes place at or near the time the fare changes. Small systems can get around this by identifying specific runs as either peak or off-peak.

Time-based fares (time-of-day, day-of-week, weekend, seasonal, etc.) are adopted for a variety of reasons:

- to encourage ridership shifts and, therefore, better utilize off-peak capacity;
- to generate higher farebox recovery rates and cover a higher share of peak costs;
- to help low income and transit-dependent users the most thru off-peak discounts;
- to recover higher shares of peak period service costs;
- to minimize ridership losses caused by fare increases due to lower demand elasticity of peak period;
- to strengthen downtown business core; and
- to stimulate public transportation use.

Peak/off-peak fares were pioneered through federal demonstrations and are becoming more generally accepted, but some cities have abandoned them due to pressure from drivers who have had to deal with arguments from passengers concerning the exact time of the change. In addition to charging a different fare depending on the time of day, some systems have implemented reduced-fare programs during the evening hours and on weekends since riders during these periods are sensitive to price changes. The net effect of such programs, however, has been to reduce farebox revenues.

Quality-Based Fares

A quality-based fare structure is one in which several types of service are provided and separate fares are charged for each type. The fares established for each service are based on the cost of providing the service and the relative elasticities of demand for each service group.

Research has repeatedly shown that public transportation riders, especially commuters and high-income users, are more sensitive to service changes than they are to price changes. This suggests that a 10% increase in service or service quality would attract more riders than would be lost by a 10% increase in fares. Reliability, comfort, and travel time are the attributes most riders would like to see improved and for which they are willing to pay. For this reason, many systems, especially bus systems, offer special, high-quality services, such as express and subscription services at a premium fare.

For a quality-based fare structure to be successful, the express or premium service must be substantially superior to local service. Unfortunately, premium prices are sometimes attached to services that do not significantly improve riding comfort or running time. Often this happens in urban settings where an express bus gets caught in the same traffic tie-up as the regular

service bus. Figure 9 summarizes the effects of four basic fare structures.

Special User Fares

In addition to one of the fare structures already discussed, most systems adopt separate fare levels for specific user groups. For example, federal regulations require off-peak half fares for the elderly and handicapped. Special rates are generally also provided for children and students. Sometimes these reduced fares are offered as a public service by the transportation system. In addition, many user-side subsidies are available to reduce fares for specific user groups such as the elderly and the handicapped. User-side subsidies are offered by federal, state, and local governments; by social service agencies; and by community groups. These subsidies generally use tickets distributed by the funding agency directly to riders. These tickets represent full or partial payment for the service received. The transportation provider is reimbursed by the funding agency for the services provided when the tickets are presented to the funding agency by the transportation system.

Sometimes, these reduced fare structures are not justified on the grounds of equity or cost, but rather are adopted in response to specific subsidies from groups like the school board. Care must be taken that fare-reduction

Figure 9: Summary of Fare Structure Systems Effects

Fare Structure	Revenue/ Ridership Generation	Equity	OPERATIONAL SIMPLICITY			
			Passenger Convenience	Collection Costs and Complexity	Operating Costs and Boarding Times	Fraud Avoidance
Flat Fares	Poor	Poor	Excellent	Excellent	Excellent	Excellent
Time-of-Day Fares	Good	Excellent	Good	Good	Good	Good
Distance-Based Fares	Excellent	Excellent	Poor	Poor	Poor	Poor
Quality-Based Fares	Fair	Excellent	Good	Good	Excellent	Excellent

SOURCE: A Manual for Implementing a Fare Change. Ecosometrics & UMTA, 1984.

policies be targeted specifically toward the group in question and that there is a genuine need for the fare reduction. Such equity fares do decrease system efficiency as drivers must verify each rider's qualifications under the fare-reduction policy.

A related fare structure is illustrated by many paratransit services which serve a specific user group only and provide a special fare for that group. For example, a demand-responsive service providing door-to-door lift service to the handicapped would probably base its fares on the ability of its users to pay.

Promotional Fare Policies

In addition to developing fare policies for overall financial planning, transportation planners can use fares as promotional tools to increase ridership. Promotional fare policies are generally provided as temporary fare reductions to increase long-term ridership.

Free- or reduced-fare promotions are often run in cooperation with local businesses and may take several forms. When businesses subsidize the promotional fare, it is usually in the hope that reduced transportation costs will bring more shoppers into downtown or shopping mall areas. The incentive may vary from a slight fare reduction to fare-free promotion at certain times (off-peak hours) or

on specific vehicles, such as park-and-ride mini-van services.

When promotional fare incentives are used strategically, they can aid in maintaining and managing ridership. Planners must be aware that careful planning and targetting of these promotions is necessary to avoid long-term revenue losses.

Fare-Free Promotions

Since 1973, Central Business District (CBD) fare-free zones have been applied in a number of different cities under varying conditions and with varying results. They are usually intended to encourage transit use for shopping trips to CBD's and to outlying shopping centers or to divert commuters from their automobiles. As new ridership may have long term effects, advantages and disadvantages should be assessed in this context.

Transfer Charges

Only demand responsive and one-vehicle systems can preclude a need for transfers. The origins and destinations of urban travel are so diverse that the planner's only hope is to minimize the number of transfers and the time between transfer points. Transfers are a function of how routes are structured. Why some riders

transfer and others don't depends on routing decisions. How this is handled is a key element in fare structure design. The usual transfer policies are:

- No-Transfer Policy
- Free-Transfer Policy
- Reduced-Fare Transfer Policy
- Temporal and Directional Transfer Policies

No-Transfer Policy

In a system without transfers, the transfer charge, in effect, is a full fare. This policy is seldom used because it reduces ridership and is viewed as inequitable. Most planners question the equity of charging one rider two fares for a single trip simply because the rider's travel pattern does not coincide with the route structure. A no-transfer policy, however, is simple to understand and enforce, reduces cost, and eliminates transfer abuse.

Free-Transfer Policy

With a free transfer policy, the rider is given a transfer on demand at no extra cost. Depending on the regulations regarding transfer use and the level of driver enforcement, transfer can be a problem. The most common form of abuse occurs when passengers obtain a free transfer and sell it or give it to a friend who is then able to ride

free. Despite possible abuses, a free transfer policy has the advantage of being easy to understand and more equitable than a no-transfer policy.

Reduced-Fare Transfer Policy

In 1983, over one-third (37.1%) of all transit systems used some form of reduced-fare transfers. Most systems use transfer slips to provide a reduced-fare transfer. The most common method is requiring passengers to pay for transfers when the slip is received on the first vehicle. As an attempt to reduce the transfer abuse method mentioned above, some systems require payment of the transfer charge on the second vehicle. The effect of this policy, however, is to create two separate monetary transactions. This arrangement does eliminate user dissatisfaction caused by purchasing transfers and then possibly not using them.

Temporal and Directional Transfer Policies

In addition to determining how the transfer charge is to be collected, the planner must identify the temporal and directional policies governing transfer usage. Most systems provide the user with 30 to 60 minutes during which the transfer must be made. Some systems provide as much as three hours of transfer time and actually encourage users to make intermediate stops. A few systems do not issue

transfers, but do sell day passes for twice the base fare, allowing unlimited riding for the entire day. For the purpose of transferring, day passes function much like free transfer slips with no directional or temporal limitations.

The directional limitations generally placed on transfers are designed to eliminate multiple trip taking. To encourage downtown shopping and other activities, some transfers can be used as CBD-zone passes, particularly during the midday.

Summary

The demand for public transportation is influenced by many factors, including the level of fares, the quality and quantity of service provided, and other factors outside the planner's control. Elasticity of demand analyses are used to determine the expected change in demand (ridership) caused by a change in fares or service.

There are no simple rules for selecting equitable and economically efficient fare structures. How transfers are handled is a key element in fare structure design. Planners need a clear understanding of the present system's limitations, of the changes that are possible within the region and of what is politically feasible.

FARE COLLECTION METHODS

The purposes of this section are:

- To review the principal fare payment options and highlight selected features.
- To illustrate how fare collection methods can impact on system costs and ridership.

An integral part of fare planning is deciding how riders will pay the fare. Decisions about fare collection methods must be made in light of the fare structure since certain fare structures preclude the use of some payment methods. For example, it is very difficult to collect a zone fare on a crowded bus at rush hour. A system's fare payment policies can rely on a single fare method such as a cash fare, but more often they rely on a combination of methods.

The principal fare collection methods to be discussed are:

- Cash Payment
- Fare Prepayment
- Tokens

- Tickets
- Punch Cards
- Magnetic Fare Cards
- Permits
- Passes
- Fare Postpayment (Billing)
- Self-Service Fare Collection

Cash Payment

The basic method of fare payment used by nearly all the transit agencies operating in the U.S. is cash, both coins and dollar bills. Although the cost of collecting, sorting, and counting coins is relatively low, the cost of handling dollar bills is very high as they must be unfolded, sorted, and counted manually. Accommodating the dollar bill has increased both labor and capital costs (through addition of dollar-bill accepting fareboxes). Currently, transit agencies spend 1-3% of total operating costs on cash fare collection, 80% of which is labor.

As fares increase beyond the one dollar level, alternatives to cash fare payment must be adopted to minimize fare collection costs and fare abuse. The most popular alternative to cash fare collection is the prepayment of fares.

Fare Prepayment

Fare prepayment includes any method of advance fare payment. This involves purchasing evidence that can later be verified as a substitute for cash payment. The most common methods of fare prepayment in use today include tokens, tickets, punch cards, permits, and passes. These categories vary primarily according to boarding procedure and period of validity. Tokens, tickets, and punch cards can be used for a limited number of rides. Permits and passes generally do not have trip limitations, but are time limited.

Sacramento's Fare Prepayment Demonstration

An interesting example of how a fare prepayment scheme can be combined with a promotional discount and an employer distribution system is Sacramento's 1978 Fare Prepayment Demonstration. This demonstration was designed to increase ridership and test various marketing tools through employer involvement in the distribution of monthly transit passes to their employees through payroll deduction and other means which increased the convenience of purchasing a pass. Efforts were also made to encourage employer subsidization of the pass.

Two years prior to the start of the demonstration project, monthly passes were available at 37 outlets in the

metropolitan area. Passes cost $12.00 and the regular fare was $.35, so a monthly pass represented an 18% discount for a daily commuter (42 trips/month). Pass sales increased steadily after they became cheaper than paying cash for the daily commute. When employer pass sales began in 1978, sales increased by 25%.

Employees were surveyed before and after introduction of a pass purchase plan through their employer. The initial survey showed that even among daily bus commuters (5 days/week), only 62% used the monthly pass. Twenty percent said it was inconvenient to buy passes, and 20% disliked the cash outlay. Only 7% didn't know about the pass or where to buy it. The final survey was conducted in the last month of a 3-month, 25% pass discount at participating employers. This survey showed an 89% increase in pass sales among participating employees. System wide pass sales were about 26% higher than would have been expected, based on pre-discount trends.

One month after the end of the discount period, system wide pass sales were 11% higher than would have been expected. Employee fare revenues during the discount period were 8% lower than before the discount, resulting in a systemwide revenue loss of about 1.2%, excluding demonstration funds. Revenues from new riders attracted are expected to make up this loss within several months.

This demonstration illustrates how a promotional fare discount combined with an innovative fare collection mechanism can impact on system costs and ridership.

Tokens

Tokens are metal, coin-like disks dropped into a turnstile at the entrance to a subway station or into a farebox on a transit vehicle. They are the fare prepayment most similar to cash since they resemble coins.

Unlike other forms of fare prepayment, tokens are reusable metal, and they can last for an indefinite period of time. They usually do not expire unless a fare change necessitates replacing all tokens in the system. This is done primarily to avoid hoarding of tokens before a fare change.

Tickets

Tickets are cards or pieces of paper given to the conductor or dropped into the farebox when a trip is taken. In self-service systems, tickets are validated at wayside locations or on-board the vehicle by the passenger. The validated ticket is kept by the passenger and then shown to the inspector on request.

Each ticket is usually good for one ride or for one zone fare. In systems with multiple fare categories, tickets are often available in a variety of denominations. Tickets are usually sold in books or strips and usually do not carry expiration dates. One problem with tickets is that they may jam farebox machines that are not specifically designed to handle this type of fare prepayment plan.

Analysis has shown that 5-7% of all tickets sold are never used. This, together with the increased ridership seen in many demonstration projects resulting from the convenience of prepayment, usually justifies a small discount to ticket users.

Punch Cards

Punch cards are cards or slips of paper with areas in which holes are punched by the driver or conductor--this substantially increases dwell time and operating costs. Credit card-sized, punch cards are functionally equivalent to most tickets and tokens. One hole is punched per ride or zone in which a trip is taken. When the specified number of holes has been punched, the card no longer has any value. Unlike bus systems that must punch each rider's card upon boarding, rail systems use the time between stops to check and punch these cards.

Magnetic Fare Cards

A variation of the punch card--and for that matter any multiple-ride ticket format--is the magnetic farecard. Implemented in several rapid rail systems in this country (such as DC's Metro) and in Europe, the magnetic farecard requires a sophisticated technology that is not yet practical for use on some systems. With the magnetic card, a passenger purchases a certain value that is recorded on the magnetic tape portion of the card. To take a trip, the rider places the farecard into the reader, which identifies the origin of the trip. When exiting, the farecard is again inserted into the reader, which computes the fare for the trip, deducts the value from the card, and returns the card to the user. Although card readers would have to be placed in both the front and back of the bus in systems with distance-based fares, the system would only require one unit per bus if a simple fare structure is used. Similar concerns need to be evaluated for intermodal and paratransit systems. The system could also incorporate unlimited-ride passes or permits as described below.

Permits

Permits are wallet-size cards that passengers display at the time of boarding. Passengers pay a partial cash fare each time they travel until the permit expires. A

photograph or another method of identification on the permit is usually used to limit use of the card to the intended person. Since permits are usually used for long periods of time, the cards are often made of heavy paper stock and coated in plastic.

Permits are ideal for targeting lower fares to special groups, such as students, the elderly, and the handicapped. For these groups, the permit is provided for a nominal fee or free of charge and is valid for one year or longer.

Passes

Passes are similar to permits in appearance, but generally do not include a photograph because of the cost. Like permits, passes must be displayed to the driver when boarding. However, passes differ from permits in that the passenger rides as many times as desired without paying any additional fee; however, passengers usually pay close to the full fare when purchasing the pass. (See the Sacramento Fare Prepayment Demonstration example earlier in this section.) This affords the user the convenience of not having to carry cash to make a trip. Pass validity periods can vary considerably, the most common being daily, weekly, monthly, and annually.

The use of employer marketed passes in Boston as a new concept in employee benefits is responsible for the shift to transit of 22 to 34% of the passholders within these companies. Of all U.S. transit operations, the Massachusetts Bay Transportation Authority's (MBTA) Pass Program is the most extensive. The program which began in the late 1970s has had favorable impact on not only increased ridership and decreased traffic congestion but also on automobile insurance costs for committed transit users. Beginning in 1979, passholders became eligible to receive a 10% reduction on their automobile insurance premiums.

A similar system is involved in most organized vanpools where the rider prepays, usually monthly, for the right to make daily trips in the van. These are usually privately sponsored, often partially subsidized by employers as part of employee benefits packages. Pricing is usually based on cost recovery. Fare collection is usually a simple, monthly or weekly transaction between the driver/owner and the riders.

Fare Postpayment (Billing)

Postpayment methods, or billing systems, work very much like long-distance telephone billing. The passenger must insert a magnetically encoded card, similar to a credit card, in a card reader upon boarding and exiting the

vehicle. The transaction records must then be entered into some sort of ledger system--computerized billing works well for this. At the end of each billing period, the passenger receives a billing statement which itemizes each trip by date, time, and distance. Fare rates are usually based on actual mileage with occassional discounts for off-peak travel.

User-side subsidy programs administered by social service agencies and paratransit systems have been able to use postpayment methods successfully. Bus-fare postpayment methods, however, have been used only in UMTA demonstration projects. This method of payment has several serious drawbacks:

- Vehicle must be equipped with card readers.
- Systemwide costs are high.
- Cash flow is impaired.
- Opportunities for fraud and misuse are great.

In addition, the system would require an elaborate data processing and billing system.

Self-Service Fare Collection

Used extensively in Europe, self-service fare collection was tried in Portland, Oregon, and on the light-rail line in San Diego. Under this method of fare collection, riders purchase tickets or passes from agents, vending machines, or for a premium price, from the vehicle

driver. Once on the vehicle, the passenger must validate the ticket, thereby ensuring that a ticket (or pass) of sufficient value has been purchased. To guard against fraud, these systems employ a series of roving inspectors who check for valid tickets and passes. Those with invalid tickets or passes are fined.

Although an additional capital costs are incurred, the benefits of self-service fare collection may be great. Differential pricing policies may be instituted to increase passenger revenues. Dwell times can be significantly reduced.

Self-service collection methods have been tried in several U.S. cities as parts of UMTA demonstration projects. All bus system self-service collection methods were abandoned at project completion due to higher than acceptable fraud rates. Many new light rail systems are still using and considering self-service methods. It is much easier to enforce payment on systems that have few stops with adequate time between stops for ticket inspection. The European self-service collection systems appear to have considerably lower fraud rates, possibly due to their longer familiarity with the system and the fact that they always use randomly (non-scheduled) roving inspectors.

Summary

Decisions about fare collection methods must be made in light of the fare structure since certain fare structures preclude the use of some payment methods. A system's fare collection policies can rely on a single fare method such as a cash fare, but more often they rely on a combination of methods. Combinations of methods can be used to ensure equity and to increase system efficiency.

PRICING COORDINATION ISSUES

The purposes of this section are:

- To illustrate the complications inherent in multi-modal system coordination.
- To discuss inclusion of private transportation providers through contractual arrangements.
- To define and discuss parking pricing strategies.

The design of public transportation pricing systems is a complex step in overall transportation system planning. The complexity of this step is increased dramatically for today's transportation planner: 1) by the current need for integrated, multi-modal transportation systems, and 2) by the current trend in reduced public subsidies and the consequent need for market-based pricing.

Coordinating Multiple Modes

Multi-modal systems involve the integrate use of different transportation modes. In a multi-modal system, for example, a commuter might travel by bus from home to a

train station, take the train into a CBD, and then take a subway to the employment site -- all for one, integrated-fare ticket or pass. Multi-modal systems use the same fare structures and collection mechanisms as single mode systems, but the complexity of establishing and collecting fares is increased greatly by the need for careful coordination and cost analysis among the various modes. The integration of multiple sponsors, providers, and managements is further complicated by the need to offer services targeted to market segments by both appropriate vehicle choice and equitable pricing.

Orange County Transit District Dial-A-Ride Example

The Orange County Transit District Dial-A-Ride DAR vehicles are scheduled, routed, and dispatched using specially designed computer software. The DAR electronic map is an automated translation data base that 1) translates street addresses into number coordinates and 2) chooses the best vehicle and plots the best route between two addresses. Offering the DAR service became practical after the map was refined to include over 25,000 streets and locations. Although some human touches are still required--for example, when operators take passenger reservations over the phone--a computer performs most of the dispatching work. DAR trips can usually be arranged in seconds.

The DAR system has been designed to serve county residents needing to travel short distances from their homes. Rather than duplicating the existing fixed-route transit system, which caters to longer journeys, DAR services concentrate on neighborhood-based travel needs. To accomplish this, the DAR service area has been divided into 31 zones, each covering about 10 square miles. Travel within a single zone is provided by one DAR vehicle. Travel through more than one zone requires transferring to another DAR vehicle. This zone structure serves as a disincentive to using DAR for longer trips that might be better provided through regular services.

Another interesting feature of DAR is its group ride service that provides direct short distance trips to groups of five or more passengers in areas not adequately served by fixed-routes. This service (which is not computer scheduled) transports groups across up to four zones without requiring a transfer--unlike regular DAR services. Group trips must be called in to DAR 24 hours in advance by a group contact. All trips require a common pick-up and destination point. A typical trip might entail transporting senior citizens to the local Lions Club or a day's outing for a group of pre-schoolers.

In 1984 DAR's fleet of 102 vehicles carried more than 1 million passengers. All vehicles are owned by the district but operated by private contractors who bid competitively

to provide service for a two-year period. Operating throughout the county, the group ride service accounted for nearly 53% of all DAR passengers and 42% of DAR vevenues. DAR fares for senior citizen and handicapped riders is $.50 per zone. Regular fares are $1.50 (peak-periods) and $1.25 (off-peak).

The DAR system integrates services that are targeted to market segments by both appropriate vehicle choice and equitable pricing. Efficiency/equity trade-offs are dealt with effectively through DAR's attention to detail in zone structure, fare structure, fare collection, and narrowly targetted subsidies.

Coordinating Public and Private Providers

Part of the complexity inherent in coordinating the services of public and private providers is the different goals of each of these groups. Public providers are established to offer services to specific groups as part of a public policy to ensure mobility. Private providers, on the other hand, want to make a profit.

The transportation planner who needs to offer integrated, multi-modal services will use a formal, legal contract and will negotiate terms with the providers. The contract is a tool through which both the economic and service quality objectives are agreed upon in advance, as

well as a means of addressing necessary concerns regarding public safety.

One of the most crucial aspects of any transportation contract which involves subsidies is the specific arrangement for compensation. There are several basic forms of compensation which include numerous specific possibilities. Each form carries certain risks for the parties involved as well as distinct advantages and disadvantages.

Fixed price contracts pay the carrier a set amount for a specified time period (quarterly, yearly, etc.) regardless of distance or special services needed. These contracts simplify agency budgeting and bookkeeping, but offer some strong disincentives. There are high risk factors for the carriers who can easily lose money under such a contract. There are also strong disincentives to offer quality service as carrier costs rise proportionately with the services offered.

Cost plus fixed fee contracts eliminate the high financial risk to the carrier, but more agency and carrier bookkeeping effort is needed to monitor service quality, costs, and productivity. The agency may trade-off cost and service quality as needed by budget constraints.

Fixed unit cost contracts pay the carrier according service units--passengers carried, miles logged, vehicle

hours, etc. These contracts offer no incentive for the carrier to provide high quality service when payment is based strictly on quantity units (passengers or miles). Quality of service delivered, however, is very difficult to verify.

User-side subsidy contracts involve the least amount of risk for the carrier, the agency, and the passenger. Users receiving subsidies can be specifically targeted, and the level of subsidy to each user can be defined individually. Quality is assured by the user's freedom to choose different services. The carrier must be sure that the period for settling bills received is long enough to minimize bookkeeping complications and short enough to minimize cash flow difficulties.

ACCESS: Pittsburgh Paratransit Brokerage Program

ACCESS (Allegheny County Coordinated Effort for Shared-Ride Services) is a door-to-door, advance reservation, shared-ride transportation system for elderly and handicapped people in Allegheny County, PA. The Port Authority (PAT) of Allegheny County hired a broker, ACCESS Transportation Systems, Inc., to organize and manage service delivery, and to coordinate the demands of individuals and agencies for this service. ACCESS was designed to provide an alternative means of transportation to persons who are not able to use the fixed-route PAT

transit service either because of their inability to board the vehicles or their inability to reach the fixed-route stops due to the extremely hilly terrain of Allegheny County, PA.

ACCESS transportation services are provided through the use of vehicles operated by private carriers, including taxi companies and non-profit human service agencies, under contract to ACCESS Transportation Systems, Inc. These carriers are responsible to the broker for providing service and meeting the service standards or specifications in their ACCESS contracts. The broker, in turn, pays for services delivered.

With one exception, ACCESS trips are priced according to a zonal fare system that establishes a uniform fare for all trips within a given zone and a schedule of computed fares for all trips between zones. The fare system was originally devised with the goal of covering the total transportation costs incurred by ACCESS. Transportation costs were higher than expected, however, and during the demonstration, the system operated at a deficit. Some of this deficit was funded by a scrip-risk account set up as part of the UMTA-SMD grant. Since its depletion, the Port Authority has provided the necessary funding.

ACCESS markets its services to a variety of user groups. Individuals not sponsored by a human service agency can also make use of ACCESS service. Anyone over

60, or mentally or physically handicapped is eligible to use ACCESS. The Port Authority provides a 75% discount on the cost of ACCESS service to people who are physically unable to board a standard PAT bus (an example of a user-side subsidy). Applicants for the discount must appear in person for an evaluation of their ability to board a bus. Those handicapped individuals who are able to board a bus must pay for ACCESS service at full price. Only 5% of ACCESS trips are taken at full price. ACCESS owes part of its success to dedicated funding provided through the Pennslyvania Lottery.

Coordinating Parking Pricing Strategies and Transit Policies

A parking pricing strategy is a market-based pricing method by which: parking costs are increased as part of transportation measures to encourage the use of high-occupancy vehicles; the actual costs of using cars is passed on to drivers; and, parking behaviors can be modified. Many local jurisdictions are experiencing problems with traffic congestion, air pollution, inefficient transit service, lack of short-term parking spaces for commercial and retail activities, and inadequate residential parking due to commuter traffic, tourism and the like.

UMTA (through SMD project funding policies) has been showing increasing interest in the development of an

approach for improving urban transportation in heavy traffic areas that both discourages the use of low-occupancy vehicles and encourages the use of high-occupancy vehicles.

The parking-pricing approach combines differentially charging vehicles for using streets or storage space (parking) and expanding services of buses, shared taxis, carpools, vanpools and other transportation modes which occupy relatively little road space per passenger carried. Certain low-occupancy vehicles are discouraged from using the short-term parking spaces on roadways through various pricing strategies. This, UMTA hoped, would encourage shifts from riding alone to sharing the ride with other passengers via transit, paratransit, or carpools. Those individuals who select to ride in low-occupancy vehicles are charged a fee that contributes to the funding of expanded transit service, roadway improvements, and parking facility construction.

Some municipalities are experimenting with the idea. The results from these experiments are not as good as originally hoped, however. A fairly typical example is Madison, Wisconsin. A significant amount of retail activity had been attracted from the downtown area to several shopping malls in the suburban sections. Short-term mid-day parking was perceived to be in short

supply and a major contributor to the retail activity problem.

A peak-period parking surcharge and a park-and-ride shuttle bus system were introduced simultaneously. The primary goal was to spread the use of available spaces to more downtown facilities and keep them from filling up until late morning or early afternoon. However, no significant shifts to transit or carpooling occurred. Most commuters simply paid the surcharge for the convenience of parking ($1.00 on top of the basic rate). Some parking shifts did occur, but not as much as was anticipated.

Summary

The complexity of coordinating transportation pricing is increased dramatically for today's transportation planner: 1) by the current need for integrated, multi-modal transportation systems, and 2) by the current trend in reduced public subsidies and the consequent need for market-based pricing. Multi-modal systems use the same fare structures and collection mechanisms as single mode systems.

The transportation planner who decides to offer integrated, multi-modal services will use formal, legal contracts inconjunction with private operators and will negotiate the contract terms. The parking-pricing approach

combines differentially charging vehicles for using streets or storage space (parking) and expanding services of public transportation modes which occupy relatively little road space per passenger carried.

STUDENT REVIEW

1. Define elasticity of demand.

2. Given a fare of $.90 which is increased to $1.00 and ridership of 3,500 which decreases by 450, calculate the point elasticity. What is the percentage of fare increase? What is the percentage of ridership decrease? Is this group of riders more or less responsive to fare change than the group described on page 62?

3. List and discuss four of the basic fare structure options.

4. Interview a public transportation system driver. Ask for a description of the system's transfer policy, the driver's opinion of the policy, and any notable experiences the driver has had because of the policy. Report your results to the class.

5. List and discuss the principal fare collection methods.

6. Why do you think Sacramento's fare prepayment system had 11% higher pass sales one month after the end of the discount period? Do you think the expected results would make this system useful for other cities?

7. Is there a multi-modal system in operation in your local area?

   a) If yes, interview the system planner. Ask how the system started, why multi-modal organization was chosen over more traditional single-mode systems, how fares were established, what (if any) user-side subsidies are offered and who pays for them.

   b) If no, discuss why you think it has not been chosen. Would the urban or rural nature of the area make such a system inefficient? Would community groups be opposed to a multi-modal system? Why or why not? What else do you think contributes to choosing multi-modal or single-mode systems?

8. Define and discuss parking pricing strategies. Does your community use any of these strategies? Do you think parking meters are designed to control parking behavior? Do you think they effectively control parking behavior?

GUIDELINES FOR STUDENT REVIEW

1. See p. 61.

2. See pp. 59-62

3. See pp. 63-80.

4. Review pp. 80-83.

5. See pp. 84-94.

6. See pp. 86-88.

7. See pp. 96-100, review Sections 2, 3, and 4.

8. See pp. 101-103.

OVERALL SUMMARY OF PRICING MODULE

Pricing systems include fare structures and fare collection mechanisms. Large operating deficits require higher fares; however, hasty rate increases can lower ridership. For all riders, the choice to ride public transportation is based on a variety of factors. Quality of service is more important than price for the vast majority. The federal government's present emphasis on reducing subsidy grants is encouraging more creative system planning and market-based fares.

Coordinated transportation planning requires careful ridership characteristic assessment. Needs-based planning must integrate this information with system costs, sources of subsidy, political and logistical restraints, and concepts of equity. Market-based pricing should be tempered with targetted programs to ensure access to mobility.

The controversial nature of fare changes makes achieving political support for pricing policies essential. Local impact groups have tremendous potential for implementing or inhibiting changes in public transportation pricing. The public transportation planner

must be aware of the interests of these groups and try to gain support for the system.

Funding is the means by which publicly supported services obtain the resources to survive. Despite its complexity, it is necessary to understand and comply with the public's requirements to use its money. Diligence and creativity are needed to keep a system financially afloat and pricing for most services depends first on the relationships between costs and funding.

System cost analysis should be an integrated step in fare structure planning. The impact of any one element on overall costs must be assessed. Typical system costs are: Labor; Capital -- Rolling Stock and Building; Transportation -- Operations and Maintenance; Administration; and Marketing and Planning. Pricing revenues must meet the difference between system costs and subsidy funding.

The demand for public transportation is influenced by many factors, including the level of fares, the quality and quantity of service provided, and other factors outside the planner's control. Elasticity of demand analyses are used to determine the expected change in demand (ridership) caused by a change in fares or service.

There are no simple rules for selecting equitable and economically efficient fare structures. How transfers are

handled is a key element in fare structure design. Planners need a clear understanding of the present system's limitations, of the changes that are possible within the region and, of what is politically feasible.

Decisions about fare collection methods must be made in light of the fare structure since certain fare structures preclude the use of some payment methods. A system's fare collection policies can rely on a single fare method such as a cash fare, but more often they rely on a combination of methods. Combinations of methods can be used to ensure equity and to increase system efficiency.

The complexity of coordinating transportation pricing is increased dramatically for today's transportation planner: 1) by the current need for integrated, multi-modal transportation systems, and 2) by the current trend in reduced public subsidies and the consequent need for market-based pricing. Multi-modal systems use the same fare structures and collection mechanisms as single mode systems.

The transportation planner who decides to offer integrated, multi-modal services will use formal, legal contracts inconjunction with private operators and will negotiate the contract terms. The parking-pricing approach combines differentially charging vehicles for using streets or storage space (parking) and expanding services of public

transportation modes which occupy relatively little road space per passenger carried.

The design of public transportation pricing systems is a complex step in overall transportation system planning. The planner must be concerned with cost recovery vs. social needs, market segment targetted strategies vs. political realities, and equity vs. efficiency trade-offs.

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Abbreviations used in this reference list:

DOT	Department of Transportation
FHA	Federal Highway Administration
NTIS	National Technical Information Service
OSMD	Office of Service and Methods Demonstrations
TRB	Transportation Research Board
TRR	Transportation Research Record
TSC	Transportation System Center
UMTA	Urban Mass Transportation Administration

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